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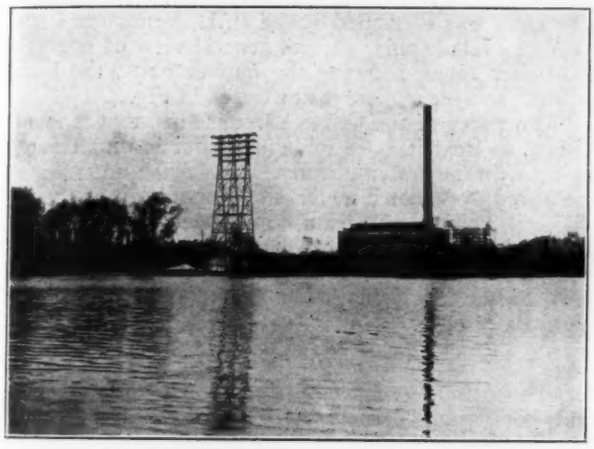


Fig. 1.—Distant View of Power House and Steel Tower for 400-Foot Span.

Fig. 2.—Interior of Turbine Room, Showing One 5,000-Kilowatt Unit.

New 20,000-Kilowatt Steam Plant at Waterloo

Citizens' Gas & Electric Company's New Turbine Station Nearing Completion—Other Important Changes and Additions to the System Give Iowa City Modern Service Features

CONGRATULATIONS may well be extended to the Citizens Gas & Electric Company, Waterloo, Iowa, and its chief executive, Austin Burt, upon the completion of a most important acquisition to the property. The new turbine station on the Cedar River, a short distance from the main business section of the city, already contains two 5000-kilowatt units in operation, and a 10,000-kilowatt unit has for many months been on order for delivery this coming July. Considering the difficulties in connection with all building operations during the past year and the slow deliveries on all classes of electrical equipment, the company has done well. In addition, extensive changes are being made to the distribution system and the substation equipment. The major change comprises a change from 2300 volts with delta-connected transformers to 4000 volts with the transformers connected in star on the high-voltage side. These changes when made, and with the 10,000-kilowatt turbogenerator in service, will give Waterloo not only one of the best equipped central stations in the state of Iowa, but one that is absolutely modern and up to date in every way.

COAL HANDLING AND STORAGE.

The steam plant has been designed and equipped to burn any grade of coal mined in Illinois and Iowa, which means that very frequently coals having high ash content will have to be consumed. The variable quality of the coals to be used, and the fact that the ash content will usually run high has been borne in mind in choosing the stoker and in choice of ash removal apparatus and layout.

The method of handling the coal has been adopted in keeping with the tendency of the times to reduce the amount of labor required, and making all operations as mechanical as possible and shortening distance of travel and reducing lost motion. The coal is brought to the side of the boiler room on a spur of the Illinois Central Railroad, from which it is dumped direct into the crusher located in the basement of the boiler room. From the railroad spur coal may be dumped into an under-water storage bin, which is lined with concrete. The capacity of this under-water coal storage basin which is shown in Fig. 3 is 15,000 tons of coal, submerged.

In planning the building more ample basement room was provided than is generally the case. Under the entire boiler house as well as the generator room in the power station proper there is fully 25 feet of headroom. Without cramping in the least, this takes care of the coal-crushing equipment, ash and coal-conveyor system and the main steam headers for the two banks of boilers in the boiler house, while under the generator room is ample space for a supplementary steam

Fig. 3.—Under-Water Coal Storage Permits 15,000 Tons of Coal to be Stored.

header, the condensers for the turbines and all of the auxiliaries.

Boiler Room Equipment.

At the present time four boiler units are in operation, while a fifth has been installed in readiness for the requirements of the 10,000-kilowatt turbogenerator. These boilers are all of the same size, namely, 600 horsepower, and were built by the E. Keller Company, of Williamsport, Pa. Each boiler is equipped with a Foster superheater, with a Green chain-grate stoker and a General Electric steam-flow meter.

From the end of the boiler room the Link-Belt conveyor makes a complete circuit of the building. From the coal crusher the conveyor takes the coal up and over to the coal bunker, where it is discharged to a horizontal conveyor which travels the length of the bunker. Continuing, the first-mentioned conveyor passes down the other side of the building to the basement and back to the crusher again, like an endless chain. The horizontal portion of the conveyor in the basement travels at right angles to the aisle which passes in front of the boiler settings. In this aisle is a narrow gauge track for a small car, which is used to bring the ashes from the grates out to the conveyor, by which they are conveyed over to the side of the building, whence they are elevated and discharged into a chute which delivers them to the railroad cars on the coal track. The same conveyor is thus employed and performs both the functions of handling coal and ash.

Reference has already been made to the coal bunker, which acts as an intermediary storage between car and stoker. This bunker extends the full length of the boiler room and is of steel, and has a capacity of 800 tons of coal. There are doors in the bottom—four in front of each boiler—through which the coal is discharged into the hopper of a 2-ton lorry. The operation of this lorry is controlled from the floor, so that it can be stopped in front of any boiler and otherwise manipulated with minimum effort. A weighing machine is installed on the floor level by which the boiler attendant is able to weigh the coal while it is in the lorry hopper. After this is done, the coal is dumped through a chute into the hopper of the stoker. The lorry was furnished by the R. H. Beaumont Company of Philadelphia, Pa. A general view of one-half the boiler room, showing the bunker exits, the lorry in back, and the stokers is illustrated in Fig. 4.

The water of the Cedar River is such that it is advisable to treat it. All make-up water is thus treated by a Cochrane water purifier. The make-up water is measured by V-notch meter, the evaporation of the individual boilers by steam-flow meters. The boiler feed-water is heated by a Cochrane feed-water heater, both feed-water heater and water purifier being supplied by the Harrison Safety Boiler Works, Philadelphia, Pa.

Turbine Room Apparatus.

The turbine room contains at present two 5000-kilowatt horizontal Curtis turbines connected to 5000-kilowatt 4000-volt generators. Operating steam pressure is 200 pounds per square inch, and the speed of the units is 3600 revolutions per minute. A view of one-half of the turbine room, taken from the switchboard gallery, is illustrated in Fig. 2. The other secetion of the turbine room contains a similar unit and space for the 10,000-kilowatt unit on order. The turbine room has high head room and is well lighted. A 30-ton crane, furnished by the Pawling & Harnishfeger Company of Milwaukee, operates the full length of the turbine room, making possible rapid repairs and handling of the heavy turbine and condenser parts. In addition to the turbogenerators is a motor-generator set for excitation. This is a General Electric induction motor driving a 400-ampere, 125-volt direct-current generator. On the same shaft and connected by means of a Clarke Duplex drive is a Terry steam turbine to be used in driving the generator in case of emergency should the alternating-current supply to the induction motor be interrupted.

The condensing equipment of each turbine is installed directly beneath its respective unit. The condensers are the Alberger company's "Spiroflo." The circulating pumps supplying them are in the basement

Fig. 4.—View Showing Half of Boiler Room.

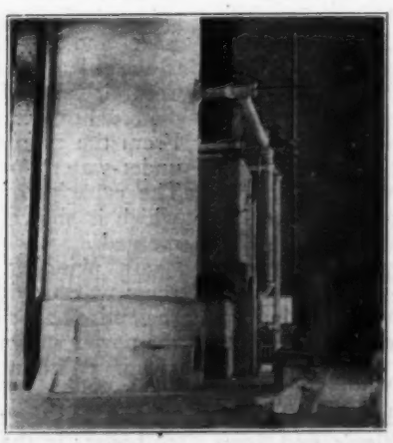


Fig. 5.—Water Purifying and Heating Apparatus.

Fig. 6.—Close View of Traveling Intake Screen.

and are of the centrifugal type, each having a capacity of 11,500 gallons per minute and each operated by a 90-horsepower steam turbine through a Wuest reduction gear made by the Falk Company of Milwaukee. Both the circulating pumps and the turbines driving them are the products of the Alberger Pump & Condenser Company.

Each turbine generating unit is also equipped with an Alberger dry vacuum pump direct connected with a horizontal steam engine.

In a gallery of the basement room under the generating units is located a supplementary steam header from which the piping to the two steam turbines and to the steam-driven auxiliaries is led off with generous application of long bends and U's.

From an electrical standpoint this is a General Electrical plant throughout, and represents standard

The electrical system employed is 4-wire, three-phase. The generator switches are located in a room

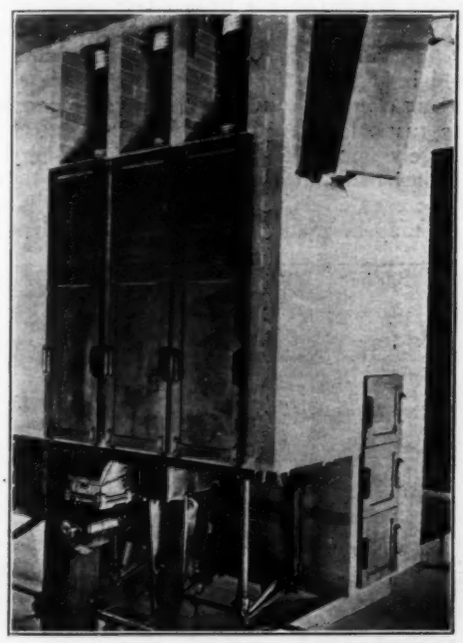


Fig. 7.—Oil Switch and Cells in Station.

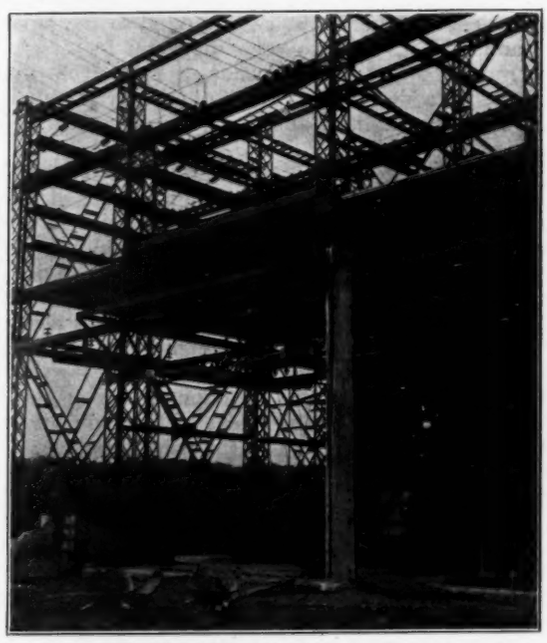


Fig. 8.—Outdoor Substation for 33,000 Volt Control.

immediately back of the generator room, and over this in the second and third stories are the line oil switches and other equipment incident to them.

The generator oil switches connect with two sets of buses on the ground floor. The lower generator bus is connected to the lower bus on the second floor. The top generator bus is connected to the top bus on the second floor. In addition, there is a riser clear through to the top floor connecting with the second and third floor upper and lower buses; also a transfer bus on the second and third floors. In short, there is an extremely flexible arrangement of buses, permitting any combination of machines desired, present and future, in the feeding of the various lines which leave the station.

The generator neutrals are connected to oil switches, which in turn are connected to a ground bus. The neutrals are connected in solidly during normal operation.

Leaving the station are the following circuits:

3 Series arc circuits.

4 Three-phase power circuits for factories.

4 Commercial power circuits for downtown light and power.

2 Four-wire circuits for residence lighting.

2 High-tension circuits supplying transformers for our-of-town circuits.

There is no high-tension equipment in the generating station proper. Thirty-three thousand volts is developed for feeding transmission lines serving other towns, but this is done, or will be, in a substation erected just outside the power plant and shown in one of the illustrations to be nearing completion. For the present there is a temporary transformer station taking care of this part of the work.

In the picture there are to be seen the oil circuit breakers already installed on the lower level. Most of the switching equipment, aside from the circuit breakers, was furnished by the Electrical Engineers Equipment Company of Chicago. The transformers which will go in here are water-cooled, Y-connected, 1400-kilovolt-amperes, 33,000 volts of General Electric manufacture. They will feed a line which loops to Charles City, coming back into the station again over two 700-foot spans across the river. The same river span towers also carry all the 4000-volt city lines, emanating from the top of the substation structure. The river span, and an exterior view of the power house, are illustrated in Fig. 1.

There is a considerable area between the power station and the river which was filled in by the central-station company and donated to the city as a part of its riverside park system. Eventually there will be a boulevard along here. Underneath this filled-in area is the concrete intake tunnel which brings the condensing water from the river to a point midway of the station where it is delivered to the pumps, at normal stage of the river without any lift. All the water is strained before entering the tunnel by means of two Link-Belt revolving screens one of which is illustrated in Fig. 6. These stand at a slight angle to the flow of water and consist of a comparatively fine mesh, as can be seen. They are arranged to be revolved not continuously but whenever it is necessary to do so for cleaning purposes. They are turned by a 6-horsepower motor through a reducer of James Manufacturing Company make.

Lighting of Offices and Drafting Rooms

Second Part of Article Discussing Modern Office Lighting—Utilization of Light—Location and Calculation of the Units

By WARD HARRISON

Illuminating Engineer, National Lamp Works of General Electric Company.

Utilization of Light.

Such factors as the nature and quality of the reflecting surface or transmitting medium, the difference in the manner in which two units of the same type but of different design distribute the light, and the care with which units have been designed to prevent the useless absorption of light, must, of course, be taken into account in selecting from several designs of a single general type the unit best suited to the purpose at hand. There are two very important factors, however, which affect the utilization of light from a unit of any given design. These are: the proportions of the room to be lighted, and the reflecting power of the ceiling and walls.

The proportions of a room are a much more important factor in illumination design than is generally supposed. For example, in a square room in which the horizontal dimension is equal to the ceiling height, perhaps 25 per cent of the light which the lamps generate will be effective in illuminating the working plane, if units of good design are used. In a square office having the same ceiling height, the same finish of walls and ceiling, and the same style of reflecting equipment, but having a horizontal dimension five times as great, fully 50 per cent of the light given by the lamps will be effective on the working plane. The reason for this difference in utilization is apparent from Fig. 9. It will be noted that a part of the light which strikes the walls of the small room, and is largely absorbed by them is directly useful in the case of the larger room. It is evident also that the actual dimensions of a room have no effect on the efficiency with which the light is used—it is the *proportions* of the room that must be taken into account.

The finish of the walls and ceiling of an office affects to a considerable degree the efficiency of a lighting installation. Anderson* records the following results of investigating a complaint of inadequate office illumination where the system consisted of indirect silvered-glass units properly located:

	Foot-Candles.	Per Cent.
Before cleaning reflectors.....	3.75	100
After cleaning reflectors.....	4.68	125
Cleaned reflectors—new lamps..	5.26	140
Cleaned reflectors—new lamps—repainted ceiling	6.75	181

The original finish of the ceiling was a yellowish-cream paint on sand-surfaced plaster. This had become somewhat blackened through two years' service. It will be noted that refinishing the ceiling with paint of good reflecting characteristics and of a somewhat lighter tone than that previously used, resulted in an increase of 30 per cent in useful light. The improvement of 25 per cent obtained by wiping out the reflectors decided those in charge of the building on a weekly instead of a monthly cleaning schedule and on the refinishing at definite periods of the ceilings of all rooms where indirect lighting was employed. It is interesting to note that, while in this case none of the original Mazda lamps had been renewed, their candle-power had dropped off only 11 per cent in the two-year period.

Where semi-inclosing units are used, the finish of the ceiling has relatively little effect upon efficiency, for the units do not depend upon reflection from the ceiling. Totally indirect units depend entirely upon reflected light from the ceiling, and, if the ceiling is dark, their efficiency will be so low as to render their use impractical. Dense semi-indirect units depend very largely upon reflection from the ceiling and although they transmit a small portion of the light, they cannot be used effectively unless the ceiling is light in color or may be made so. On the other hand, light

Fig. 8.—Semi-Inclosing Units in a Drafting Room. The Glass Skylight Precludes Indirect or Semi-Indirect Lighting.

reflected from the ceiling has a general downward direction, and, for this reason, totally indirect or dense semi-indirect units are less dependent for efficient operation upon the finish of walls or other vertical surfaces than are semi-inclosing units, which distribute the light more broadly.

That percentage of the total light generated by the lamps which is effective in illuminating the working plane is known as the co-efficient of utilization. If 40 per cent of the light which a lamp gives is, under certain conditions, available at the working plane, the co-efficient of utilization for the reflecting equipment is in that case 40 per cent, or expressed as a fraction, 0.40. Coefficients of utilization for totally indirect, dense semi-indirect, and semi-inclosing units of good design, when used in square rooms with various ceiling heights and with various finishes of walls and ceilings, are

*Earl A. Anderson, Transactions of Illuminating Engineering Society, Vol. XI, No. 9. Discussion following Samuel G. Hibben's paper on "Economics of Office Lighting."

TABLE NO. 2.

COEFFICIENTS OF UTILIZATION

This table applies to installations in *square rooms* having sufficient lighting units symmetrically arranged to produce reasonably uniform illumination. To obtain the coefficient for any rectangular room, find the value for a square room of the narrow dimension and add one-third of the difference between this value and the coefficient for a square room of the long dimension.

Reflection Factor: Ceiling			Light 70%			Medium 50%		Dark 10%
Reflection Factor: Walls			Light 50%	Medium 30%	Dark 10%	Medium 30%	Dark 10%	Dark 10%
Reflector Type	Light Output	Ratio = Room Width / Ceiling Height						
Indirect	90° to 180°—81%	1	.22	.19	.17	.14	.12	.07
		1½	.27	.24	.22	.17	.15	.09
		2	.31	.28	.26	.20	.18	.11
		3	.36	.33	.31	.24	.22	.13
Mirrored Glass	0° to 90°—.9%	5	.42	.39	.37	.28	.26	.16
Semi-Indirect	90° to 180°—70%	1	.24	.21	.19	.16	.14	.10
		1½	.30	.27	.24	.20	.18	.13
		2	.34	.31	.28	.23	.21	.15
		3	.39	.36	.33	.27	.25	.18
Dense Opal	0° to 90°—10%	5	.45	.42	.39	.32	.30	.21
Semi-Enclosing	90° to 180°—30%	1	.32	.28	.26	.27	.25	.23
		1½	.40	.36	.33	.34	.32	.30
		2	.45	.41	.38	.39	.37	.35
		3	.52	.47	.44	.45	.42	.40
Opal Bowl	0° to 90°—69%	5	.59	.54	.51	.51	.48	.46
Dense Opal	90° to 180°—70%	1	.41	.37	.34	.35	.33	.32
		1½	.49	.45	.42	.43	.41	.39
		2	.54	.50	.47	.48	.46	.44
		3	.60	.56	.53	.53	.51	.49
Bowl-Frosted Lamp	0° to 90°—60%	5	.67	.63	.59	.56	.57	.54

given in Table 2. The coefficients of utilization for rectangular offices may be readily approximated as explained in the note at the head of the table.

LOCATION AND NUMBER OF LIGHTING UNITS.

The location and the number of the outlets are affected by considerations of the constructional features of the office, of uniformity in lighting, and of the avoidance of glare. It is not infrequently the case, even in small offices, that beams divided the ceiling into rectangular bays, and then a symmetrical arrangement of units is desirable for appearance.

In the case particularly of offices built for renting purposes, careful consideration should be given to locating the units in such a way that, if old partitions must be removed or new ones built in to suit the requirements of a new tenant, the outlets already installed will still be usable. This factor alone is frequently of sufficient importance to justify the use of a greater number of outlets than necessary to suit the existing lighting requirements. Special structural features, such as the location of ceiling beams and the placement of doors and windows, should receive attention. The sketches of Fig. 10 illustrate how the use of 6 units in a room where 4 would satisfy conditions of uniformity, permits the change from a general office to a private one where, due to the location of the windows, a change to two offices of equal size would be practically out of the question. The cost of installing, say, 6 units, need not necessarily be greater than that for 4, for the cost of glassware increases, not in proportion to its diameter, but at a much faster rate, and the difference in its first cost may be sufficient to offset the greater cost of wiring. It is an advantage, too, if the number of different sizes of units and lamps employed in an office building can be kept small in order to facilitate replacement from stock. Sometimes it may be desirable to wire for locations where it is thought units may at some future time be desirable, but to seal the wires beneath the plaster until required.

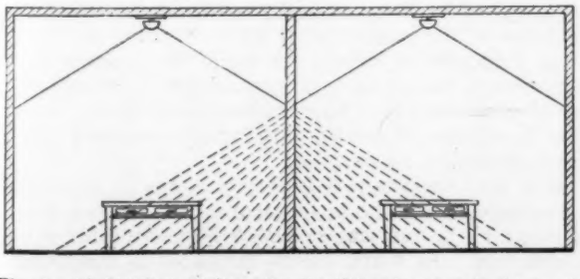


Fig. 9:—Light That Strikes the Partition Is Largely Lost. In a Large Room This Loss Is Eliminated.

Where totally indirect or dense semi-indirect units are used, and the greater part of the illumination comes from a large area on the ceiling, the question of direct glare is automatically cared for. On the other hand, because of the large ceiling area which is brightly lighted with such units, it is difficult to avoid a certain degree of specular reflection in polished surfaces.* Such reflection is not, of course, nearly so annoying as the image of a bright unit itself. Reflected glare from direct-lighting equipment can sometimes be avoided by arranging the desks along a wall so that specularly reflected rays will travel away from the eye, rather than toward it, as shown in Fig. 12.

From a study of the light distribution of units, it has been possible to establish fairly definite rules for determining the number of rows of units required, the proper spacing distance between units, and the distance from the walls to the nearest rows of units. In the application of such rules are involved, of course, the width and length of the room to be lighted and the height at which the sources can be located above the working plane. The ratios given in Table 3 insure satisfactory illumination as regards both quantity and direction in all parts of the room. Attention is called to the fact that the height of the light source above the illumination plane in the case of indirect or semi-indirect units is the height of the ceiling above the desk or table tops, for ceiling acts as the principal light source.

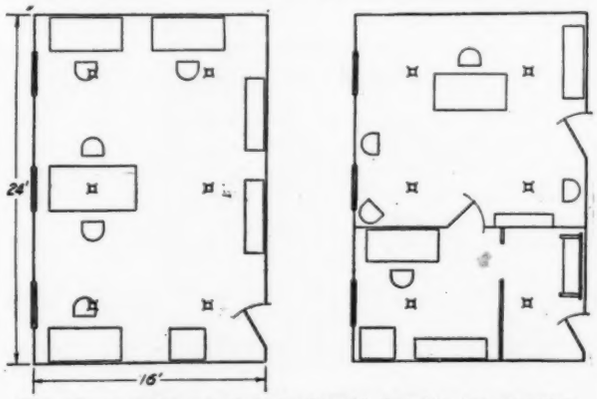


Fig. 10.—Location of Outlets Should Provide for Possible Changes in Office Arrangement.

The distance at which totally indirect and semi-indirect units should be suspended from the ceiling is determined largely by considerations of appearance. The distance should not be so small that corners of the ceiling appear objectionably dark nor should it be so great that light is directed from the unit to the walls, or that a bright spot is formed beneath the unit. Between these limits, variations in the hanging height affect the efficiency of the installation only slightly in offices of the usual proportions. In case the shadows cast upon the ceiling by the chains or rods supporting the bowl or by the bowl itself prove objectionable, they may be eliminated by dipping the lamps in an etching solution.

In order to simplify the design of an office lighting system, the ratios given in Table 3 have been used as the basis for the construction of the charts appearing as Fig. 13. The upper chart of Fig. 13 is applicable

*See Fig. 6 in the first part of this article. Electrical Review, May 18, 1918, page 827.

Fig. 11.—Semi-Inclosing Units in a Draft'ng Room Where the Dark Ceiling Will Not Permit Indirect or Semi-Indirect Lighting.

to calculations for direct-lighting semi-inclosing units, the middle one to those for totally indirect, and the lower one to those for heavy-density semi-indirect units. Attention is again directed to the fact that light-density semi-indirect and open-reflector units are not well adapted to office lighting.

Illumination Calculations.

The actual calculation of illumination is very simple when the type, location and number of lighting units have been decided upon. It remains then only to supply a size of lamp which will provide sufficient intensity of light for the nature of the work at hand.

An intensity may be chosen, usually within the limits of 4 and 12 foot-candles, depending upon the character of the work, which will serve as a basis upon which calculations may be carried through. This intensity should be chosen with care; it should not, however, be viewed in the light of a definite value which must be obtained exactly, but rather as a desirable value which if secured will be satisfactory. In order that the accumulation of dust on lamps and reflecting equipment, and the depreciation of lamps in service will not cause the illumination to fall below the desired standard, it is necessary to increase the selected intensity by 15 to 40 per cent, depending upon how favorably the office in question is located with respect to freedom from smoke, dust, fumes, etc. In general it is not considered good practice to make a smaller allowance than 20 per cent for depreciation, that is, to multiply the selected intensity by a factor

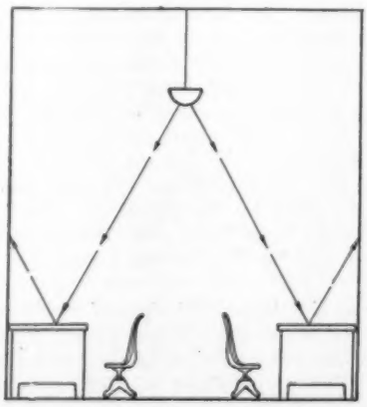


Fig. 12.—Arrangement of Desks to Avoid Specular Reflection.

smaller than 1.20. As has been pointed out, it is important that a schedule of regular and frequent cleaning be adopted and faithfully adhered to if maximum satisfaction is to be obtained.

The total light flux that must be supplied to the illumination plane is determined by multiplying the intensity in foot-candles by the area of the office in square feet. The product so obtained divided by the coefficient of utilization applying to the type of unit selected as used under the given conditions, gives the total light flux which the lamps must generate. The total light flux to be generated divided by the number of outlets gives the lumens which must be supplied per outlet. By reference to Table 4, a size of lamp may be selected which will supply the required lumens.

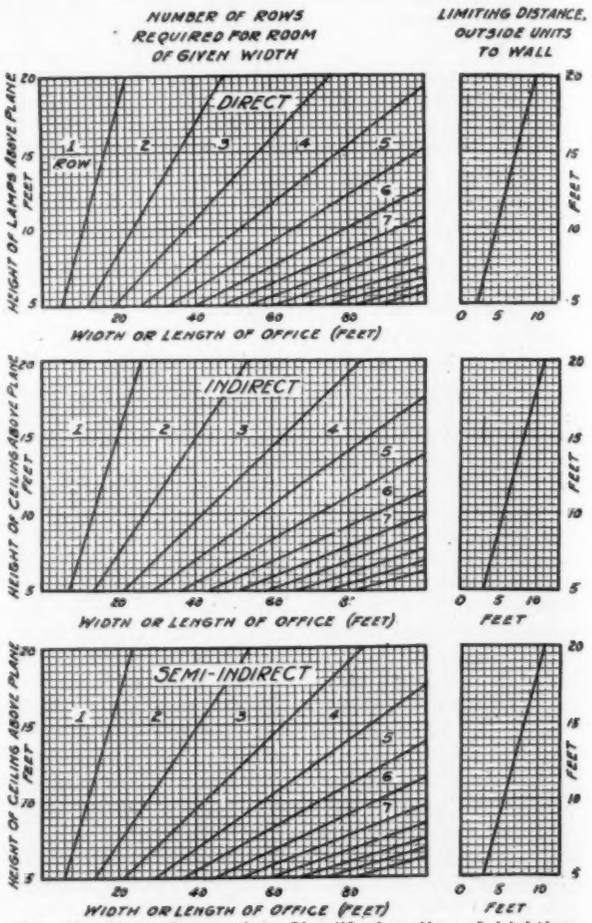


Fig. 13.—Chart Designed to Simplify Location of Lighting Units in Offices.

It will usually be found at this stage of the calculation that a choice must be made between a size of lamp which will not give so high an intensity as that originally chosen as the desirable value and one which will give a higher intensity. Good practice usually dictates the choice of the larger size of lamp, allowing the margin as a factory of safety, for while the expense will be increased, the increase is not without a corresponding value, whereas the choice of the smaller lamp might cause a system otherwise satisfactory in every particular, to fail of its purpose.

It is very important that Mazda lamps be operated at a voltage at least no lower than that for which they are rated, if the full value of their high efficiency is to be obtained. In many cases, lamps of a somewhat lower voltage may be economically employed, for the

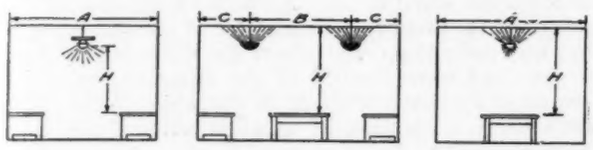
increase in cost occasioned by more frequent lamp renewals and the greater energy consumption frequently represents a very small outlay for the increase in illumination obtained.

TABLE No. 3

MAXIMUM RATIOS OF SPACING TO HEIGHT OF LIGHT SOURCE FOR SATISFACTORY OFFICE ILLUMINATION

System	Limits for One Row of Units	Limits for More Than One Row of Units	
	A / H	B / H	C / H
Indirect*	1.3	1.5	0.6
Dense Semi-Indirect*	1.2	1.5	0.6
Direct Semi-Inclosing	1.1	1.4	0.5
Direct Dense Opal	1.1	1.4	0.5

*With indirect or semi-indirect the ceiling is considered the light source.



Solution of Illustrative Problem.—A lighting system is desired for a general office which measures 16 feet wide, 24 feet long, and has a ceiling height of 12 feet. The ceiling is light in color and the walls are of moderate reflecting power—a combination which is usually met in offices, and which permits the use of heavy-density semi-indirect or totally indirect units; for this office dense semi-indirect units are selected. A beam running crosswise of the ceiling divides it into two bays which measure approximately 16 by 12 feet.

By reference to the chart, Fig. 13, adapted to the use of heavy-density semi-indirect units, it is seen that two rows of units are required for an office 16 feet wide where the distance between the light source (the ceiling in the case of indirect units) and the working plane is 9½ feet, and that if these rows consist of 2 units each, this office, 24 feet long, can be uniformly lighted. The units should not be located more than 5¾ feet from the walls, as shown by the chart; in this case they will be mounted 4 feet from the side walls and 8 feet apart, and about 5¾ feet from the end walls and 12½ feet apart lengthwise of the office. The distance from the end walls might be varied slightly so as to locate the units along the center line of the bay. The units would be suspended at a distance of 2 to 3 feet below the ceiling.

Six foot-candles is a desirable value of intensity to select as a working value in designing the illumination for a general office. This value multiplied by a depreciation factor of 1.2 gives an intensity of 7.2 foot-candles as a desirable initial value. By multiplying the area of the office, 384 square feet, by 7.2, the foot-candle intensity desired, it is found that 2765 lumens must be supplied to the illumination plane.

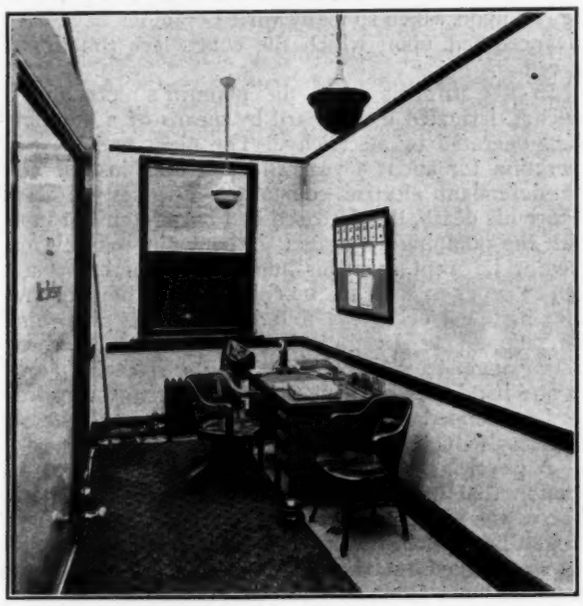


Fig. 14.—Totally Indirect Units in a Private Office.

From Table 2 the coefficient of utilization for dense semi-indirect units in a room 16 feet square and 12 feet high having a light ceiling and medium walls is found by interpolation to be approximately 0.25; for such a room 24 feet square the coefficient is 0.31 with the same units. For a room 16 by 24 feet, then, the coefficient, as explained in the heading of the table, is 0.25 + ⅓ (0.31—0.25), or 0.27.

By dividing the lumens required on the working plane, 2765, by the coefficient of utilization, 0.27, the lumens which the lamps must give initially is obtained.

The four lamps required must generate, initially, 10,250 lumens. Each lamp must supply, then, 2560 lumens. By reference to Table 4 it is seen that the 200-watt Mazda C lamp, which has an output of 2920 lumens, most nearly supplies the required number and this lamp is accordingly selected. The extra 360 lumens which the 200-watt lamps supply go to increase the allowance for depreciation or "factor of safety." The intensity supplied when the installation is new will now be about 35 per cent above the 6-foot-candle value which it is desirable to maintain as a minimum.

TABLE No. 4

TECHNICAL DATA ON 110-125 VOLT MAZDA LAMPS

Watts	Total Lumens	Lumens Per Watt	Diam. of Bulb, Inches	Max. Over-All Length, Inches	Light-Center Length, Inches	Position of Burning	Rated Ave. Life, Hours
Mazda B Lamps							
10	75	7.52	2⅛	4⅝	2⅞	Any	1,000
15	128	8.55	2⅛	4⅝	2⅞	Any	1,000
25	230	9.17	2⅛	5¼	3¼	Any	1,000
40	378	9.45	2⅛	5¼	3¼	Any	1,000
50	476	9.52	2⅛	5¼	3¼	Any	1,000
60	585	9.74	2⅛	5½	3½	Any	1,000
100	1,010	10.13	3¾	7⅛	5⅛	Any	1,000
Mazda C Lamps							
75	865	11.53	2¾	6½	4⅞	Any	1,000
100	1,260	12.57	3⅛	7⅛	5⅛	Any	1,000
150	2,050	13.66	3⅛	7⅛	5⅛	Any	1,000
200	2,920	14.61	3¾	8⅜	6	Tip Down*	1,000
300	4,850	16.11	4⅝	9¾	7	Tip Down*	1,000
400	6,150	15.32	5	10	7	Tip Down*	1,000
500	8,050	16.11	5	10	7	Tip Down*	1,000
750	12,800	16.98	6½	13⅜	9½	Tip Down*	1,000
1,000	18,000	17.95	6½	13⅜	9½	Tip Down*	1,000
Mazda C-2 Lamps (Blue-Bulb)							
75	600	8.0	2¾	6½	4⅞	Any	700
100	870	8.7	3⅛	7⅛	5⅛	Any	700
150	1,400	9.4	3⅛	7⅛	5⅛	Any	700
200	2,000	10.1	3¾	8⅜	6	Tip Down*	700
300	3,350	11.2	4⅝	9¾	7	Tip Down*	700
500	5,600	11.2	5	10	7	Tip Down*	700

All lamps of 200 watts and smaller fit medium-screw sockets. Lamps of 300 watts and larger fit mogul-screw sockets.

*Orders for Mazda C lamps should specifically state if lamps are for use in other than pendent position.

Court Decisions on Accidents from Overcharged Service Wires

Resume of Several Important Cases Showing Care That Must Be Taken by Utility Companies to Guard Against Accidents

By CHESLA C. SHERLOCK

THE liability of electric companies for overcharged service wires is a proposition which has been called to the attention of the courts from time to time. Perhaps there is no one point of the law upon which so many varied opinions have been advanced but upon which the courts are practically agreed.

In a California case, the plaintiff's decedent, a rancher, irrigated his orchard by means of a pumping plant operated by electricity. The plant had been in operation for about a year and had been installed by the defendant electric company. For several days before his death, the deceased had been having trouble with the pumping apparatus. About nine o'clock one evening he went from his house to the pumping station in order to start the machinery. An hour or two later his dead body was found in the well pit behind the pump. He was in a kneeling posture, his head resting against a discharge pipe leading from the pump. In one hand was held the lamp socket from the drop cord suspended in the pit and the hand was severely burned.

A physician who examined the body gave it as his opinion that death had resulted from electric shock. There was evidence tending to show that glass from broken lamp globes was scattered about, that the motor was burned out, that the insulating material on the lamp cord was punctured and that the insulating lining set into the lamp socket to prevent contact of the interior electrical connection with the brass case was wholly burned away over one of the terminals.

It was shown that the defendant delivered its current to the decedent, at a pole near the pumping plant, from primary wires carrying 6600 volts. Through a transformer, a current of 110 volts was taken off for the lighting of the plant.

The plaintiff brought her action on the theory that the defendant in installing the electrical wires and appliances had employed unsafe connections and a deficient ground wire with the result that an excessive and deadly current had passed from the primary side of the transformer into the secondary side, and through the drop cord into the body of the deceased. The defense was conducted on the theory that decedent must have fallen from the ladder while he was descending to the pit and that he was either killed by the fall or by the long continued passage of 110 volts from the drop cord through his body.

It was shown, however, that 110 volts would be practically harmless to a man of the physical strength and condition of the deceased. There was evidence that the ground wire was, in fact, defective and insufficient. A verdict of $12,500 was given in favor of the plaintiff.

The Supreme Court, in affirming the judgment, held that the evidence fully supported the verdict and said that where the defendant affords "the means for the service," it is required to use "very great care." The court added that "the presence of a death-dealing current in the wire through which defendant had contracted to furnish 110 volts was sufficient to afford reasonable evidence of negligence on its part. It is the rule in this state that where electricity is furnished to a system installed and operated exclusively by the owner of the premises, the doctrine of *res ipsa loquitur* has no application. But where the defendant in such a case had some control of the situation, either by reason of its construction or its operation of the plaintiff's plant, a showing of accident without plaintiff's fault shifts the burden of proof."

A New York Case.

In a New York case, the facts disclosed that a man of thirty-seven, enjoying perfect health, went into the basement of his house and an hour later was found dead there, lying on the floor beneath a drop light.

A small hole was found in his clothing just over the heart and at the same point a burn was found on the skin. A similar burn was found on the sole of his left foot, and a hole through his woolen sock and his slipper. The drop light was suspended by an insulated cord from a nail in the ceiling. The nail to which the cord was attached held also a wire supporting a swinging shelf. The evidence tended to show that if the decedent attempted to turn on the light that the wire on the swinging shelf would touch a place near his heart.

The power supplied the house was at 120 volts, brought over a secondary circuit consisting of two wires from a primary wire carrying 2400 volts. The 120 volts were drawn off from the primary circuit through an ordinary transformer. It was shown that about half an inch of insulation was gone from the primary wire at a point inside the transformer and that this uninsulated half inch was within 9/64 of an inch from the iron transformer cover. The pole to which the transformer was attached was wet on the night of the accident. Evidence showed that 2400 volts will jump from one wire to another 2/7 of an inch away.

The jury found that death had resulted from a breaking down of the transformer, permitting an excessive force of electricity to enter the decedent's house, and that the defendant had been negligent in the premises, and that no contributory negligence on the part of the deceased appeared.

The Supreme Court affirmed the judgment for $40,000, saying that it was the defendant's duty to exercise a "high degree of care," to protect the deceased against excess current, and the evidence was sufficient to support the verdict.

In another New York case, the court said:

"When a corporation assumes control of the distribution of a substance as dangerous to human life as electricity, it is its duty to exercise at least reasonable care to prevent its escape in a death-dealing manner.

The force causing the death of the decedent, being in the control of the defendant, and the casualty being such as in the ordinary course of the business does not happen if reasonable care is used, proof of these circumstances, regardless of direct proof of defective appliances, affords, in the absence of explanation, sufficient evidence that the accident occurred from want of due care on the defendant's part."

A Peculiar Accident in Kentucky.

In a Kentucky case, the plaintiff, a blacksmith, was supplied by the defendant with an electric current of 110 volts for the purpose of lighting his shop. The plaintiff was working late one afternoon, and noticing that he needed light, he reached up to turn on a bulb near him. As he touched the fixture, an excessive force of electricity escaped through his body, throwing him 15 feet upon his face and injuring him.

It appeared that the pole which carried the low-voltage wire from which plaintiff received his light, supported also wires carrying, for street cars and the city lighting system, a current of 4500 volts. The weight of the wires and a heavy transformer box caused the pole to lean, bringing about a sagging of the wires, which brought one of the high-voltage wires into contact with the low-voltage wire from which plaintiff received his light. It was shown that the insulation of the wires had been burned off at the point of contact. It was found that this condition had been brought about gradually by the leaning of the pole, that it could have been discovered by a casual inspection, and that anyone making such inspection might reasonably have anticipated, weeks previously, such an accident as that which occurred.

The court, in speaking of the case, said:

"Electricity is a powerful and deadly agency. The rule has been adopted that those who manufacture and use it must exercise the utmost care to protect others from danger. They are not insurers, for the manufacture and sale of electricity is lawful, but in handling so dangerous an agency, care proportionate to the danger must be observed, and to this end nothing short of the utmost care is sufficient."

Injured While Testing Lights.

In a Georgia case, the consumer's servant was injured while testing a light by trying to turn it on. The electric company had been asked to repair the defective light and the injury was caused by an excessive amount of current passing into his body as he was in the act of turning on the light.

There was evidence to show that the primary and secondary wires had been permitted to come in contact with each other outside the transformer, with the result that the full primary circuit had been transmitted to the secondary wire and into the plant.

Said the court: "It has been held by high authority that, where the plaintiff shows that he has received a shock from a high and dangerous voltage, the law raises a presumption of negligence against the electric company furnishing the electricity, and the burden is then upon the electric company to negative the presumption."

Opinion of Supreme Court.

The United States Supreme Court has had this question brought to its attention and has announced the following opinion:

"Besides, the defendant engaged to supply a current of low voltage, reasonably safe and suitable for lighting, while the current delivered on the occasion was of high voltage, extremely dangerous and unsuitable for lighting purposes. These circumstances pointed so persuasively to negligence on its part that it was not too much to call upon it for an explanation. Of course, if the cause of the injury was one which it could not have foreseen and guarded against, it was not culpable; but, in the absence of that or some other explanation, there was enough to justify the jury in finding it culpable."

In a California case, the court was not inclined to impose liability upon the electric company for the reason that the plaintiff had installed all his own fixtures and appliances and had allowed the electric company no opportunity to inspect his work. He had merely run his wire out to the company's pole, and the meter box of the electric company was not even located on the plaintiff's premises, but on the company's own pole.

Said the court: "When we consider the multitudinous uses to which electricity is now being applied and assuming that the user receives it by means of appliances of his own choice, erected by himself, and under his own control and management, as in the present case, it would be an intolerable burden to require of the power companies what is here contended for."

It is well established that the companies owe the utmost care to their patrons to furnish them the current in a safe and careful manner. The courts have held that, in an absence of contributory negligence, the burden is on the companies to show freedom of negligence. Only the utmost care and caution and the most painstaking inspections at frequent intervals will satisfy the courts on this important question.

NEW YORK ELECTRICAL INDUSTRIES HONORED FOR ACTIVITIES IN BOND CAMPAIGN.

Secure Subscriptions for Over Nine Million Dollars—Each Branch of Industry Represented by Committee.

The honor flag of 21 stars has been awarded to the New York Electrical Industries Liberty Loan Committee in recognition of its achievements in the Third Liberty Loan campaign recently closed, in which bonds amounting to $9,457,250 were sold. This committee, for Greater New York, was organized by General Chairman Theodore Beran, who was in charge of nine division chairmen, the group sales being as follows:

Manufacturers' branch offices, E. D. Kilburn, chm....	$4,854,650
Manufacturers' division, J. Nelson Shreve, chm.....	1,895,450
Jobbers' division, George L. Patterson, chm.....	804,650
Elec. Cont. & Dealers' division, Louis Kalischer, chm..	760,850
Inside Elec. Workers' division, Wm. Walsh, chm.....	463,800
Elec. Societies' Auxiliary div., J. M. Wakeman, chm.	320,350
Manufacturers' Agents' division, Chas. Crofoot, chm..	223,650
Central Station Auxiliary division, A. Goldman, chm..	73,650
Electrical Inspectors, J. C. Forsyth, chm.....	60,700
Total.....	$9,457,250

Theodore Beran was general chairman of the Electrical Industries Committee; James R. Strong, vice-chairman; E. Donald Tolles, secretary; and H. C. Calahan, assistant secretary. O. H. Caldwell and James H. McGraw, Jr., had charge of publicity and speakers. Other members of the committee, in addition to the division chairman, were A. S. Adams, Harry Alexander, A. Hall Berry, Wm. Courtney, Chas. L. Eidlitz, B. H. Ellis, Samuel Frost, V. C. Gilpin, H. T. Hochhausen, Lon Keller, Jacob Landy, C. P. LaShelle, W. F. Leggett, J. E. McClernon, E. J. Murphy, Franz Neilson, J. A. Pizzini, J. P. Ryan, C. P. Scott, M. S. Seelman, L. L. Strauss and Meyer Zucker.

Editorial Comment

Electrical Contractors Must Perfect Their Organization

LIKE other branches of the building industry, the electrical contracting business is passing through a critical period. Except in munition, shipbuilding and cantonment centers, building activity is at very low ebb and all contractors are suffering more and more from severe depression in business. Electrical contractors, a large part of whom have been operating on a very small margin of profit, are confronted with the most grave crisis ever experienced by their craft. In a great many cities they have allowed themselves to become the victims of ruinous competition with its train of vicious practices, violent jealousies, and loss of prestige among the architects and builders they do business with. The possibility of prolonged continuance of the war may force many of them to the wall if heroic remedial measures are not taken in time.

Fortunately, a timely solution of these difficulties was worked out last fall in the form of the Goodwin Plan for broadening the business opportunities of the electrical contracting fraternity by becoming the recognized retail distributors of electrical appliances and supplies. The enthusiasm with which this plan has been received at all meetings of the national, state and local associations where it has been fully explained shows the high regard of the progressive electrical contractors of the country for its fairness, breadth, and practicability. To all appearances, it seems to be a panacea for most of the evils of the business and offers a ready solution for the most urgent problems now to be dealt with. To carry it out effectively, however, requires a widespread and whole-hearted co-operative effort, first among the contractors themselves through a reorganized and broadened scheme of federated contractors' associations.

The national association and some twenty-five of the state associations have adopted the Goodwin Plan and are actively proceeding to put into effect in the proper way by first reorganizing along the broadened lines and extending their membership to include practically every firm doing a contracting or retail merchandising business. Difficulties are being experienced in some quarters, however, in bringing additional members into the fold. These are due to several causes, chief of which are inexcusable ignorance of the true meaning and scope of the Goodwin Plan which has been the big live topic of the last six or more months, lingering prejudices against former competitors, and lack of progressiveness combined with satisfaction in remaining in the rut.

Ordinarily anyone has the privilege of remaining in the rut if it is his pleasure, but when he impedes the general traffic and the progress of others his stubbornness becomes a menace. Moreover, the rut shows evidences of developing into a muddy slough wherein the nonprogressive objector is likely to sink beyond hope of rescue. Unfortunately, the failure (through bankruptcy or otherwise) of the rut-ridden electrical contractors is a burden to the entire electrical industry. Somebody has to stand the loss and in most cases it is distributed among many other elements of the industry.

The cut-throat competition which has held sway in many contracting circles is now coming to be realized as a suicidal policy. It has left many bitter scars, however, which are retarding the movement that requires cordial co-operation by all electrical contractors before the co-operation of other electrical interests can be obtained. In some cities there have been as many as four local competitive organizations of the contractors all severely jealous of each other. These should be disbanded and all the best energies they possess put behind the wheel of the reorganized electrical contracting fraternity.

Its salvation depends on united action. The old saying, "United We Stand, Divided We Fall," applies with special force in the present situation. With the solid backing of the electrical contractors throughout the country there is almost no limit to the advantageous developments that may be brought about. No contractor, whether large or small, can afford to hesitate. Let him join whole-heartedly in perfecting the organization of his industry or suffer the bitter consequences of having the rescuing agency slip out of his hands by delay.

The First Practical Step Toward Fuel Conservation

WHEN sign lighting was curtailed and lightless nights came into vogue last winter as palliative measures toward relieving the fuel famine, the ELECTRICAL REVIEW in its editorial columns of December 1 pointed out that the effect of these practices would have a moral rather than physical effect upon coal consumption. Further, it went on to say, "The remedy lies in educating those responsible for the plants as to how best operate them and insist that they employ means and apparatus for doing it. . . . Those plants so situated that they can purchase energy efficiently made instead of with gross extravagance, an extravagance that appears almost criminal under circumstances as they exist today, should be

compelled to do so. Those plants that must continue to operate should be regulated and their performance controlled by Federal, State or civic authorities, that the nation's coal supply be not needlessly and wantonly impoverished. Civic departments for boiler inspection and smoke abatement and allied insurance interests should immediately operate with Federal or State authorities to improve those plants where feasible without radical change."

The fuel situation of the early part of this year, and the situation today have amply demonstrated the wisdom and timeliness of that editorial. Today we are told that the prospects for the coming winter indicate an even more serious state of affairs than last winter unless radical improvement occurs. Whether conditions improve remains to be seen. However, the Fuel Administration is taking radical steps that hold promise of improvement.

The first practical step is being taken toward conserving the nation's fuel. What the ELECTRICAL REVIEW advocated more than six months ago is now to be done. The Fuel Administration is preparing to circulate a questionnaire to all steam-making power plants from which may be obtained some idea of their capacity, condition and efficiency. Inspections are to be made and the questionnaires checked up. In cooperation with the Fuel Administration, inspectors from the ranks of engineering societies, universities, and other allied interests will visit plants. Plant owners and operators are to be instructed. Opportunity and advice for improvement of plants will be given. If these do not suffice, there are other remedies.

Between now and the time when the war has been won, and the reconstruction period following, many of the power plants in use today will undergo many changes. Some will disappear. Some will go over to central-station supply, to the mutual advantage of all. Many will remain, as economic factors dictate they should. But they will be different plants, and the saving by having them different will have demonstrated to their owners the wisdom of keeping them in efficient condition.

There is a place for the isolated plant, as for all things. But the day is passing when the nation's fuel may be indiscriminately squandered according to individual whim. The first practical move is on the way toward conserving the nation's fuel supply. It is being made later than it might have been made, much later than we would have wished. But it is in the making. Fuel will be conserved because power plants will be improved or eliminated. And when the war is won it is unlikely that the power plants will revert to the laxness and waste of today, that is at once a disgrace to the power plants and a rebuke to the nation.

Improved Lighting of Offices

SUMMER seems to the ordinary individual to be a poor time to discuss office lighting because artificial lighting is used least in offices at this season of the year; especially is this true since "summer time" or "daylight saving" has still further decreased the need for artificial illumination now. The country has seen an extraordinary example of the value of preparedness, however, and the old saying in time of peace prepare for war has never been so fully appreciated as now. Good lighting for offices is therefore a timely subject, because the necessary betterments should not be left to the fall months when a great deal of artificial light will suddenly be required, for which it will be difficult to provide the equipment promptly. Moreover, electrical contractors and manufacturers of lamps, reflectors and other lighting equipment are not so rushed now and can take much better care of rewiring and re-equipping office lighting circuits and fixtures.

Improved lighting for offices has been discussed for many years in lighting circles and is about as highly a perfected an art as there is in the entire illuminating field. The very large proportion of offices that are still not well lighted shows that there is yet a great deal of room for improvement. This improvement is becoming more urgent every day because of the rapid change in office help. In no avenue of commercial and industrial employment has there been so great an influx of women workers since we entered the war as in offices. These new workers are still largely inexperienced; they also require a more fastidious environment than men employees. Both these considerations call for improved lighting, for an abundance of good light minimizes mistakes by a new employee and at the same time makes a cheerful atmosphere where contented workers are more likely to be found than in a gloomy office.

At a time when maximum efficiency is paramount, office managers cannot afford to neglect securing the best possible lighting of their offices, especially in view of the fact that the higher efficiency of modern lighting equipment gives such superior results at little or no increase in cost.

A renewed agitation for good office lighting is therefore very timely, as is a review of the best practice in this field. In an article by Ward Harrison, the second half of which appears in this issue, this subject is handled in a very able manner by an engineer who has given a great deal of study to the matter. Mr. Harrison's suggestions and comments are so lucid as to require little further discussion. Especially noteworthy, however, is the emphasis he properly places on glare-free illumination, which heretofore has not been given the consideration in office lighting that it deserves. Visual comfort, accuracy of work and general all-around efficiency are so markedly increased by a lighting system which is devoid of glare that the slightly higher cost it involves is well warranted, especially in view of the greater efficiency of modern lamps and reflectors. Mr. Harrison's condensed and yet comprehensive treatment of the entire subject is so full of valuable information that we commend particularly careful reading and preservation of his valuable article.

Week's Events

American Institute Elects Officers—Colonel Carty Awarded Edison Medal—Missouri Utilities Hold War Convention

ELECTRIC POWER CLUB TO HOLD ANNUAL MEETING AT HOT SPRINGS, VA.

War Service Meeting to Be Important Feature of Convention—Many Prominent Men to Speak.

The Electric Power Club announces its next annual meeting at Hot Springs, Va., to open May 30 and to close June 1. At the opening session, 11 a. m., Thursday, reports of officers will be heard, and announcements made. The afternoon and evening of that day will be devoted to committee meetings and reports of committees.

Friday's sessions are reserved for a War Service program. Walter Robbins, chief of the Power Equipment section of the War Industries Board, will explain the activities of his section, exhibiting charts to illustrate what it is hoped to accomplish with the new powers under which the War Industries Board is now working. The activities of the General War Service Committee of the Electrical Manufacturing Industry will be presented by R. K. Sheppard, chairman.

A report of the War Service Committee of the Manufacturers of Electrical Supplies will be made, and there will be brief discussions on the following problems, led in each case by the gentlemen named; Raw Materials and Priorities, R. K. Sheppard; Labor, F. S. Hunting; Transportation and Embargoes, S. L. Nicholson; Fuel Supply and Conservation, J. C. Hobart; Engineering and Other Economies, James Burke; War Trade Board, C. L. Collens, 2d.

At Saturday's sessions, there will be a report on Uniform Cost Accounting System; a paper and curves showing how Manufacturing and Commercial Costs vary under changing market and labor conditions; and papers on Co-operation in Export Trade after the war under the Webb bill, and on Trade Acceptances.

A. L. Osborne, vice-president of Westinghouse Electric & Manufacturing Company, who is to be present, will talk on the activities of the National War Labor Board, unless it shall happen that the Board is in session at that time.

EXTENDING ELECTRICAL EQUIPMENT TO THE ANTHRACITE FIELDS.

The Lehigh Valley Coal Company contemplates electrification of its entire chain of operations in the Lehigh field of Pennsylvania as soon as the war is over. The Oneida No. 4 slope will be converted from steam to electricity this summer. The Gowen & Wolf's mines have just been put into the service with electric power to run the machines and hoists.

The Cranberry Creek Coal Company plans to make its Cranberry mines the most complete electrical colliery of the hard-coal fields by 1920. Overhead trolley wires have been abolished and the mine locomotives are operated by storage batteries. The pumps will also be run by electricity.

UTILITIES CO-OPERATING WITH FUEL ADMINISTRATION IN ZONE DELIVERIES.

Committee on Gas and Electric Service Aiding in Perfecting Arrangements.

George W. Elliott, secretary of the National Committee on Gas and Electric Service, has furnished a very complete and excellent summary of the work that has been done to date by the United States Fuel Administration in connection with this committee.

Following are some of the main points:

"The Fuel Administration has found it necessary to modify the zoning system of bituminous coal distribution and will no doubt make other changes from time to time as conditions arise making these necessary. Among the consumers of the classifications named in preference list No. 1 of the Priority Board who are to receive coal in preference to any other individual or class of consumers, public utilities as a whole are listed.

"Every effort is being made by the Fuel Administration to increase production and to secure for all public utilities sufficient coal to permit them to have a reserve for the winter. The situation in the East is far from satisfactory. New England is very anxious regarding future conditions and supply. The Middle West seems to be in much better shape, as it is securing reserve stocks. This should go a long way toward carrying through the winter if the users in that section can continue for the next few months to receive coal in the quantities shipped recently.

"Special efforts are being made to increase the production of coke which is important in so many ways for national security and defense.

"The week of June 3 to 8 has been designated as 'Coal Week' by the Fuel Administration for every state in the Union. Preparations have been made to bring squarely before the people the Fuel Administration's message on the necessity for placing coal orders early. Thousands of motion-picture houses will show the message.

"It is desired to urge all members to make every effort to secure as much storage coal as possible and as soon as possible. This is most important for the future success of their plants. Favorable reports issued from time to time should not lessen the activities of central-station companies in securing coal for next winter. Nothing as yet has been decided regarding the cancellation of coal contracts made previous to August 23, 1917.

"The Administration has appointed Thomas R. Brown of Pittsburgh as administrative engineer for the Pittsburgh district, and G. P. Billing as special staff assistant.

"These appointments were made as a preliminary step toward putting into operation a general plan for fuel conservation in power plants. The plan contemplates the saving of from 10 to 20 per cent—25,000,000 to 50,000,000 tons—of the coal used annually in indus-

trial plants. This will be accomplished by means of correct operating methods, without the delay and expense involved in the installation of new or improved equipment.

"The program is at present in effect in the Pittsburgh district, which will be used as a model, with the expectation that the campaign for the elimination of waste will be extended to all the principal coal-using districts. The program comprises certain fundamentals:

1. Personal inspection of every power plant.

2. Classification and rating of every power plant based upon the thoroughness with which the owner conforms to recommendations of the Fuel Administration, involving the generation and use of power, heat and light.

3. An administrative engineer to be placed in charge of the work in each state or district. It will be one of his duties to rate the plants from information received through reports of inspectors, who will merely act to collect certain definite information regarding each plant."

Uniform Government Contract Prepared.

The committee has been very active during the last month with the Quartermaster and Ordnance Departments in connection with furnishing details as to available power and in making contracts for the additional power required by these several departments.

"The War Department in making contracts for electric service with the various electric light and power companies, has found that conditions vary in different communities and in order to avoid complications it contemplates having prepared a form of contract which will be satisfactory to both the public utilities and the War Department and which, it is hoped, will be in accordance with the regulations of the various public service commissions. The public utilities have presented for signature their forms of contract, authorized and regulated in accordance with the view of the public service commissions, and these have varied in numerous instances, as stated, hence the decision of the War Department to issue a uniform contract.

"The matter of turbine deliveries to public ulitities is becoming more acute all the time, and the War Industries Board finds it necessary to practically assign dates of delivery for the manufacturers in accordance with the importance of the needs of the utilities. While this is not intended as a commandeering process, it has been found necessary in order that the needs of the Government for the various plants in construction throughout the country shall be taken care of as to power equipment."

ELECTION OF OFFICERS OF AMERICAN INSTITUTE.

Report of Board of Directors and Announcement of Election Result at Annual Meeting.

The thirty-fourth annual business meeting of the American Institute of Electrical Engineers was held in New York City on May 17, President E. W. Rice, Jr., presiding. Secretary Hutchinson briefly presented the annual report of the Board of Directors for the fiscal year ended April 30, 1918. This, as usual, includes a condensed resume of the activities of the Institute, of special interest being the review of the work of various special committees, delegates and miscellaneous members in co-operation with government bodies in helping prosecute the war. This participation of Institute representatives and members has been very active and has been keenly appreciated by the authorities. At present 824 members are wearing the uniforms of the Army or Navy, and a large additional number are serving in civilian capacities.

The war has had an important effect on nearly all Institute activities. The membership is more fully appreciative of the importance of engineering in war as is shown by the increased attendance at the section meetings. The membership of the Institute on April 30 was 9282, a net increase of 572 during the past fiscal year. The finances of the Institute, as reported in detail, are in a very favorable condition.

The report of the tellers of the annual election of officers was read and the following declared elected as officers for the next year beginning August 1, 1918:

President—Comfort A. Adams, Cambridge, Mass.

Vice-presidents—William B. Jackson, Chicago, Ill.; Harold Pender, Philadelphia, Pa.; John B. Taylor, Schenectady, N. Y.; F. B. Jewett, New York, N. Y.; Allen H. Babcock, San Francisco, Cal.; Raymond S. Kelsch, Montreal, Canada.

Managers—Frank D. Newbury, Pittsburgh, Pa.; Guiseppe Faccioli, Pittsfield, Mass.; Walter I. Slichter, New York, N. Y.

Treasurer—George A. Hamilton, Elizabeth, N. J.

President-elect Adams was called on and made a short address, expressing his appreciation of the honor and of the confidence shown him. In the midst of the greatest war the responsibility is also very great. He felt that the most important function of the Institute must be to help in winning the war until the war is won and therefore urged the co-operation and assistance of every member to this end.

The remainder of the evening's program was concerned with the presentation of the Edison Medal to Col. John J. Carty, and is reported more at length on other pages of this issue.

PROMINENT SPEAKERS TO ADDRESS CONVENTION OF SOUTHEASTERN SECTION, N. E. L. A.

The Southeastern Section of the National Electric Light Association will meet in convention at Atlanta, Ga., on June 19 and 20. Speakers for the convention are announced as follows:

J. W. Lieb, president, N. E. L. A., and vice-president, New York Edison Company; P. S. Arkwright, president, Georgia Railway & Power Company; James Mitchell, president, Alabama Power Company; Z. V. Taylor, president, Southern Public Utilities Company; Dr. David Marx, rabbi, Jewish Synagogue, Atlanta; J. S. Blecker, vice-president, Columbus Power Company; L. K. Comstock, contracting engineer, New York; C. W. Stone, manager, Lighting Department, General Electric Company; E. H. Sniffin, manager, Power Department, Westinghouse Electric & Manufacturing Company.

CONTRACTOR-DEALERS OF WORCESTER DISTRICT HOLD MONTHLY MEETING.

The Worcester district association of the Massachusetts State Association of Electrical Contractors and Dealers held its May meeting on the 9th at Fitchburg, which is to be the place of meeting in the future. The 28 members from Worcester and elsewhere who went to Fitchburg were entertained at the Fay Club at the latter place. The association was addressed by J. E. Wilson, state secretary, and others.

COLONEL CARTY RECEIVES EDISON MEDAL.

Distinguished Audience Witnesses Presentation at Annual Meeting of American Institute of Electrical Engineers.

Upon Dr. John J. Carty, colonel in the United States Army Signal Corps and chief engineer of the American Telephone & Telegraph Company, has been bestowed the Edison Medal in recognition of his services in developing the science and art of telephone engineering. The medal was presented on May 17 at the annual meeting of the American Institute of Electrical Engineers in New York City and this constituted the principal part of the evening's program.

The exercises in connection with presentation of the medal were simple but impressive. A statement of the history and significance of the medal was made by Dr. A. E. Kennelly, who was chairman of the Institute's 1917 Edison Medal Committee. Dr. Michael I. Pupin, of Columbia University, told of the work of Colonel Carty that ranks him as the foremost telephone engineer in the world. In presenting the medal to Colonel Carty, a brief address was made by the president of the Institute, E. W. Rice, Jr., who is an engineer of note and also president of the General Electric Company. After Colonel Carty's reply, brief remarks were made by Dr. Alexander Graham Bell, inventor of the telephone.

Dr. Kennelly explained how the Edison gold medal was founded in 1904 by the Edison Medal Association, an organization composed of old associates and friends of Thomas A. Edison. It is awarded annually by a committee of 24 members of the American Institute of Electrical Engineers, and was first awarded in 1909, the recipient being Elihu Thomson; the other medalists were Frank J. Sprague, George Westinghouse, William Stanley, Charles F. Brush, Alexander Graham Bell and Nikola Tesla. The medal was designed by James Earle Fraser, and bears on its obverse a portrait of Thomas A. Edison, with suitable inscription of the award, and on its reverse an allegorical conception of the genius of electricity crowned by fame.

Dr. Pupin's address dwelt on many interesting features of Colonel Carty's career, which in many ways resembled that of Faraday. Carty had never attended college, but at the age of 18, on leaving the Latin School at Cambridge, Mass., he started his work with the Bell Telephone System in 1879 and at 28 he became chief engineer of the New York Telephone Company. His pioneer work in telephone engineering was reviewed by Dr. Pupin, who also described how his wonderful intuition and imagination led to the rapid development of long-distance telephonic communication. As chief engineer of the American Telephone & Telegraph Company, Carty built up a splendid organization of loyal engineers, he himself setting the example of untiring service in the advancement of the telephonic science and art.

In presenting the Edison Medal, President Rice referred briefly to Colonel Carty's achievements as an engineer, scientist, administrator, soldier and man.

Colonel Carty's Address.

In accepting the medal, Colonel Carty made an address in which he referred with his characteristic modesty to his own work, the credit for which he said belonged to the entire Bell Telephone System. He rapidly traced the growth of telephony and showed how its invention and every substantial improvement that has been made in it has been an American achievement, so that the telephone art is primarily an American art. Practically every improvement has been made by or adopted and put to use by the Bell system. Members of the American Institute of Electrical Engineers have taken a very conspicuous part in these developments. The progress of telephony has been due to the fine combination of scientific minds and engineering talent, and it is to the credit of Mr. Vail and his colleagues in charge of the Bell system that they had the great foresight forty years ago to form this potent combination which is now recognized as necessary for the success of all large undertakings.

Turning to the use of telephony in the war, Colonel Carty referred to the part played therein by U. N. Bethell and Major General Squier, both of whom were present and under whom he serves in his civilian and military capacities. "To these two men, more than to any others," said Colonel Carty, "belongs the credit for what the telephone has done and will do in winning this great war. At a time when it seemed that America was not going into the war, at a time when we were discussing preparedness, General Squier was looking far ahead, as is his custom, and he saw that the Signal Corps as then constituted was far too small, it was utterly inadequate, as, indeed, were all other departments of the army, to cope with the new situation, and he came to me to see what could be done with regard to the formation of a reserve of men from the Bell Telephone System who would volunteer and be ready to go to war, should it happen that this country would ever get into the war. I took General Squier at once to Mr. Bethell, and we three had a conference, at which it was agreed by Mr. Bethell that the Bell system would furnish many thousands of men for this reserve, and thereupon was started the organization of the Signal Corps Reserve. Battalions were formed all over the United States, and when the war broke out there were practically twelve battalions of Bell telephone men ready to take the field. If it had not been that we had the generous and far-seeing and patriotic action of Mr. Bethell, on the one hand, backed by his board of directors, and of General Squier on the other hand, when General Pershing sailed he would have been sadly deficient in his signal corps equipment. As it was, young men going about their daily occupations as telephone engineers suddenly received word to put on the uniform and on the same ship, and in General Pershing's own personal party, went along some of these young men as officers of the Signal Corps to France. Altogether there were more than twelve of these battalions formed, and all of them are in France doing wonderful work, which will form a very important part of the history of this war.

"I could go on and tell of many other plans of preparedness which General Squier laid out, and which Mr. Bethell and his colleagues, and myself and assistants, have worked out—many of these are still military secrets—but I assure you that the work that has been done under General Squier in war telephony is quite wonderful.

"It was not only in the Signal Corps, under General Squier, that the idea of the Bell system being ready for war was developed, but in the Navy also, under Secretary Daniels. It was on May 6, 7 and 8, 1916, that the Navy ordered the mobilization of the telephone and telegraph resources of the Bell system, in fact, Secretary Daniels turned over to the Bell system the task of supplying all the communications of the Navy for three days, during which time the Navy went on a simulated war basis, and no method of communication was employed except that furnished by the Bell system.

"To show how thoroughly prepared the Bell system was, during these three days Admiral Benson, the chief of ordnance of the Navy Department, started in talking to Seattle, then he talked to Mare Island in San Francisco harbor, then to San Diego, then to the mouth of the Mississippi, into Tortugas, next to Charleston and Norfolk, then to the Washington Navy Yard and Annapolis, then to the Philadelphia Navy Yard, then to the Brooklyn Navy Yard, then to the Charlestown Navy Yard at Boston, and then to Portsmouth, and finally back to the Great Lakes Training Station.

"He called up in quick succession each one of these naval stations and gave actual orders, and received information from each of these places by word of mouth. At another time, during the mobilization, simultaneous telegraphic messages were sent to all of these stations over the telephone wires while those wires were being used by telephone for conversation. Then, at another time, during the mobilization, separate messages were sent to all of these stations, and then finally a message by telephone was sent from Admiral Benson to the *New Hampshire* at Hampton Roads by wireless telephony, ordering Captain Chandler of that ship to get under way, and to proceed to sea and report his position every hour by telephone, which he did. That was the first time in our Navy, or any other navy, that such a thing was done. At that time also Mrs. Chandler talked to her husband, she being in Washington in her home, and he on the bridge of the ship. Another thing that was done at that time was that the captain in command of the Navy Yard at San Francisco talked by wire to the Arlington tower and thence by wireless to Captain Chandler on the bridge of his ship out in the Atlantic, and it so happened that she was in a very heavy squall, and these two officers talked to each other and each recognized the other's voice.

John Joseph Carty.
Colonel, Signal Corps, United States Army. Chief Engineer, American Telephone & Telegraph Company.

"So when the war broke out the Navy Department had a mobilization plan ready, and in one hour after the word was given, the men in the Bell system were moving in all parts of the United States, and that system which worked so successfully during the trial mobilization went into immediate effect where it, in greatly augmented form, has been giving wonderful service to the Navy ever since. And the plans which General Squier has so successfully worked out have also gone into effect."

In concluding his remarks, Colonel Carty spoke of the magnitude of the Bell system, which includes a personnel of over 200,000 men and women. About 6000 of its men are now in the war. The engineering department is but a small part of the system and, while it does important work, this would be useless if not matched up by the many other departments and coordinated by a far-sighted and liberal executive staff, the whole forming a great and progressive institution —a distinctively American institution composed of loyal Americans true-blooded to the core.

Brief Sketch of Colonel Carty's Career.

John Joseph Carty was born at Cambridge, Mass., on April 14, 1861. Nature endowed him with a clear, keen mind, a liking for mechanical experimentation and an infinite capacity for work. He was graduated from the Cambridge Latin School and intended to enter Harvard University, but was prevented by a serious trouble with his eyes, which made it impossible for him to prepare for the college-entrance examinations.

He became interested in the telephone, then a new scientific device unappreciated by the majority of persons, and in 1879 started work in the Bell system with the Telephone Dispatch Company, of Boston. In 1887 he took charge of the Western Electric Eastern Cable Department, and later of the Western Electric Eastern Switchboard Department. In 1889 he became chief engineer of the New York Telephone Company, then the Metropolitan Telephone & Telegraph Company, and while in this position, twice directed the technical work in connection with the reconstruction of this company's plant, first, when the system was changed from ground circuit to metallic circuit, and the second time when it was changed from local battery to common battery. In 1907, he became chief engineer of the American Telephone & Telegraph Company, the civilian position he now holds. Colonel Carty is now giving practically all of his time to the development of the nation's Signal Corps work in this country and "over there."

More than any other man, Colonel Carty is responsible for the development of telephone engineering as it is known today, and it is peculiarly fitting that he should receive this new honor at a time when he is working day and night to promote the best military use of mediums of communication which have been developed largely through his efforts in time of peace for the advancement of the nation's social, commercial and industrial activities. He is well known as the engineer of the great transcontinental telephone line, the longest in the world, and as the engineer who made possible wireless telephoning over distances up to 5,000 miles.

Having entered the telephone business when it was

in its infancy, it would be difficult to find a phase of its development which does not bear some imprint of his genius. His technical achievements are so numerous as to prevent full recounting. He first pointed out the correct theory of induction between telephone circuits, showing how to obtain a balanced metallic circuit and devising methods for correctly transposing phantom telephone circuits. That was in 1887. In 1888 he developed the bridging bell and pointed out the importance of the bridging principle of telephone construction in obtaining efficient operation of telephone systems and in constructing balanced metallic circuits. In 1889 he invented the principle of the best and most generally used common-battery system, by which a number of telephone instruments may be simultaneously operated from a single central battery. During this period he also devised important improvements pertaining to switchboard circuits having to do with the busy-test feature and the connecting in of operators' instruments.

In 1912 the telephone engineering force built up and directed by Colonel Carty had so far overcome the difficulties in the way of underground telephony as to make possible all-underground talking between New York and Washington, and by 1913 they had extended the range of underground telephony to connect Washington and Boston. 1914 witnessed the fruition of the efforts of these engineers to bring transcontinental telephony into existence, and in 1915 Colonel Carty was able to present to the world important developments in wireless telephony, which made possible the hurling of words through space across the American continent from Washington to Mare Island, Cal., from Washington to Hawaii, 4900 miles distant, and from Washington to Paris, bringing Europe and America into speaking distance of each other for the first time. His co-operation with the Signal Corps and the Navy is referred to above in his address.

Colonel Cary's technical telephone achievements alone would entitle him to his pre-eminent position in his field, but he also occupies an equally high place in the regard of scientists because of the character of his work in directing, developing and co-ordinating telephone engineering. Men who have been associated with him say that his success is due not only to his scientific genius, but also to his understanding of the requirements of the service he has done so much to improve. He has insisted upon the importance of determining the requirements of the service before undertaking to develop specific ideas. He has always emphasized the necessity for getting the full set of facts in each case and of studying the effects of growth so that a new device may not only be satisfactory at the start but may fit into the system as it develops. The several hundred engineers engaged by the Bell System in conducting researches testify to the value which Colonel Carty places upon this phase of telephone work, just as they do the emphasis he puts upon the importance of keeping bad devices and methods out of the telephone plant. Colonel Carty is known also for his marked ability to make friends with and inspire confidence in those with whom he comes into contact, so that his name is one to conjure by among those for whom he works, those with whom he works and those who work for him.

Colonel Carty has been the recipient of many honors conferred by American colleges, scientific and engineering societies. He is a member of many of these organizations and has served as president of the American Institute of Electrical Engineers and the New York Electrical Society.

SOCIETY FOR ELECTRICAL DEVELOPMENT ELECTS OFFICERS.

Henry L. Doherty Re-elected President—Convenience Outlet Campaign Planned.

The annual meeting of the Society for Electrical Development, Inc., was held on May 14 at the offices of the Society in New York. James R. Strong presided at the meeting.

General Manager Wakeman read his annual report, reviewing the work of the Society during the past year and suggesting activities for the coming year. The treasurer's report was read and accepted, together with the auditor's report, showing that the books had been audited and found correct to April 30.

The election of directors resulted as follows:

For directors to represent central-station interests—J. E. Montague, four years; W. W. Freeman, two years; E. N. Sanderson, one year.

For directors to represent manufacturing interests—L. P. Sawyer, four years; W. D. Steele, one year.

For director to represent jobbing interests—Fred Bissell, four years.

For director to represent contracting interests—G. M. Sanborn, four years.

At the board of directors' meeting which followed the annual meeting, with J. E. Montague presiding, it was decided to continue the work of the Society for another year upon the present basis and to conduct a "Convenience Outlet" campaign as suggested by the general manager. An appropriation was made to carry on the campaign along national lines, similar to the "Wire Your Home" and "America's Electrical Christmas" campaigns.

The Society will issue broadsides, booklets, folders, lithographed posters, etc., and will ask local committees to procure the co-operation of the entire electrical industry in educating the public to an appreciation of "Convenience Outlets" of all kinds, such outlets to be preferably on a separate circuit from the lighting. It is felt that the time is opportune for such a campaign when domestic servants are scarce and people have money to spend upon appliances, the proper use of which plays an important part in fuel conservation.

Henry L. Doherty was again elected president. Joseph E. Montague was elected to succeed W. H. Johnson as vice-president and as a member of the executive committee. Gerard Swope was elected chairman of the executive committee. James M. Wakeman was reappointed general manager and James Smieton, Jr., secretary-treasurer for the ensuing year.

MANUFACTURERS IN PARTNERSHIP WITH THE GOVERNMENT IN WINNING THE WAR.

Brigadier General C. C. Williams, acting chief of ordnance, in addressing a recent meeting of ordnance officers, at Washington, D. C., said that production was now a most important factor in winning the war so far as the Ordnance Department was concerned. Matters of engineering and design were established, administration and control were in full swing, contracts had been placed for vast amounts of equipment of every description and the success of the ordnance program now depended upon the ability of the manufacturers to meet the issue. The manufacturer was now the partner of the Government. His task was a mighty one. General Williams said that he was confident that the manufacturer would rise to the occasion.

WAR CONVENTION OF MISSOURI ASSOCIATION OF PUBLIC UTILITIES.

Annual Meeting at St. Joseph Shows Delegates Are United in War Aims.

The Missouri Association of Public Utilities held its twelfth annual convention at St. Joseph, Mo., on May 17 and 18, which was attended by more than 100 central-station operators and their representatives. The problems growing out of the excessive costs of operating, and the difficulty of obtaining an increase of rates whereby to meet increased expenses formed the basis of various papers and much discussion.

In the absence of Bruce Cameron, president of the association, the convention was called to order by Hugo Wurdack, St. Louis, former president, who made a brief address, closing by introducing Dr. J. C. Whitsell, mayor of St. Joseph. A response to the mayor's address of welcome was given by Henry W. Kiel, mayor of St. Louis.

The annual address of President Cameron was read by the secretary. In this address the conditions under which utility companies were operating were fully set forth, and inasmuch as united action was necessary, the holding of this convention was deemed important.

J. H. Van Brunt, President-Elect.

J. S. Tritle, district manager of Westinghouse Electric & Manufacturing Company, presented a paper on "How the Manufacturer Is Meeting the Problems That Have Been Created by War Conditions." His paper was a most interesting resumé of how that company is disposing great forces and facilities in putting through government and commercial work of gigantic proportions.

This was followed by a paper on "Taxes Affecting Public Utilities," by H. Spoehrer, secretary-treasurer of the Union Electric Light & Power Company, St. Louis. In this paper the subject was treated in an authoritative manner, making it a most useful statement of the case.

Lieut. Governor Crossley, head of the Fuel Administration of Missouri, addressed the convention. He outlined some of the difficulties met last winter in making distribution of fuel as equitable as possible. His interesting address closed with a patriotic appeal. The fuel question received attention in the discussion that followed.

Col. P. J. Kealy, president of the Kansas City Railways Company, read a paper on "The National Movement for Increased Revenue." This subject was considered of paramount importance, and Col. Kealy's paper received close attention. This, as with other papers read at the convention, was printed in pamphlet form and is a valuable contribution to information on utility affairs.

The closing paper was by H. Wurdack, chairman of the Rates and Revenue Committee, on "The Effect of War Upon Public Utilities in State and Nation."

The officers elected are as follows:

President, J. H. Van Brunt, St. Joseph Railway, Light, Heat & Power Company.

First vice-president, J. M. Scott, Kansas City Gas Company.

Second vice-president, L. P. Andrews, Sedalia Water Company.

Third vice-president, H. Spoehrer, Union Electric Light & Power Company, St. Louis.

Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Company, St. Louis.

Executive committee: L. H. Egan, assistant general manager, Union Electric Light & Power Company, St. Louis; J. E. McLeod, comptroller, Laclede Gas Light Company, St. Louis; Col. P. J. Kealy, president, Kansas City Railways Company; B. C. Adams, Empire District Electric Company, Joplin, Mo.

Public Affairs Committee: I. R. Kelso, chairman, Light & Development Company, St. Louis, Mo.; E. D. Bell, Illinois Traction System, St. Louis, Mo.; J. R. Woodfill, Lawrence County Water, Light & C. S. Company, Aurora; C. L. Proctor, Empire District Electric Company, Joplin, Mo.; V. L. Elbert, St. Joseph Gas Company; J. F. Porter, Kansas City; Bruce Cameron, United Railways Company, St. Louis; E. C. Deal, Springfield Gas & Electric Company.

The consensus of opinion at the convention was summed up in the following resolutions:

BE IT RESOLVED BY THE MISSOURI ASSOCIATION OF PUBLIC UTILITIES IN CONVENTION ASSEMBLED:

1. That it is the sense of this Association that all public utilities are entitled to increases in rates sufficient at least to cover the increased costs, since the Public Service Act took effect, of money, materials and labor essential to producing the service; and that new or changed schedules of rates filed pursuant to said Act designed to that end, should be allowed to take effect by operation of law and should not be suspended by the Commission and should continue in force unless after full hearing and a sufficient adverse showing is made to justify the modification of such new schedule.

2. That all operating costs incurred by franchise requirements, rules and regulations, not essential to maintenance of service, should be discontinued so far as possible for the duration of the war.

3. That all capital expenditures heretofore required by franchises, commission orders, rules and regulations or otherwise for plant extensions and betterments for new business should be discontinued so far as possible for the duration of the war, as such expenditures at this time become a permanent capital charge based on present abnormal costs and will be reflected in abnormally high service rates throughout the future.

4. That this association appoint a committee of five to present these resolutions to the Public Service Commission, and that said committee urge upon the Commission the importance of adopting some plan which will afford speedy and adequate relief to the utilities of this state along the lines set forth in these resolutions.

IMPRESSIVE WAR CONVENTION HELD IN CALIFORNIA.

Joint Meeting of All Electrical Interests at Del Monte Under Auspices of Pacific Coast Section, N. E. L. A.

The joint convention of the Pacific coast electrical organizations, held at Del Monte, Cal., May 6 to 11, inclusive, has passed into history as one of the most important of the meetings of electrical interests held this year. Perhaps the foremost result of the gathering was the crystallization of thought and action for meeting war problems.

The organizations which met in joint sessions consisted of the Pacific Coast Section of the National Electric Light Association, the Pacific Division of the Electrical Supply Jobbers' Association, and the California State Association of Electrical Contractors and dealers. The attendance was thoroughly representative of the activities for which those organizations stand, about 400 delegates being present. The spirit of patriotic service pervaded the atmosphere of the convention, and ways and means of marshaling the electric forces represented in co-operating with the Government to prosecute and win the war were given a dominant place in the addresses, papers and discussion.

Addresses at Opening Session.

The opening address by H. F. Jackson, of the Sierra & San Francisco Power Company, president of the Pacific Coast Section of the N. E. L. A., accurately gauged the spirit of the convention in his patriotic appeal for the co-operation, in effort and singleness of purpose, of the electrical industry in war service.

John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, in a forceful address, as chairman of the Public Policies Committee, pleaded for water-power development, fuel conservation, co-operation and a sane policy of informing the public. He outlined the attitude of the public utilities, as such, and urged a policy that would gain a hold on public confidence. He closed with the presentation of a resolution asking Congress to pass water-power legislation, which was adopted.

The Commercial Section.

One of the most important of the sessions was that of the Commercial Section, Friday afternoon, when W. L. Goodwin gave one of his characteristic addresses on co-operation as outlined under the Goodwin plan. He urged the acquirement of the national vision instead of the sectional viewpoint.

Women's War Service.

A striking feature of the convention was the Women's War Service session, at which was emphasized the need of an open-minded policy in working out the problem of Americanizing foreign-born residents, and in this connection was brought out the problems and opportunities arising from the greater employment of women in the electrical industry.

The Engineering Section.

The War Service Session of the Engineering Section was opened by a report on "War Service Problems" by the Engineering Committee, of which J. E. Woodbridge of Sierra & San Francisco Power Company was chairman. The work on conservation and war measures had been carried on by sub-committees in co-operation with state and federal officials.

The subject of "Possible Water-Power Development" in California, Nevada, Arizona and New Mexico was presented by Fred H. Fowler, district electrical engineer for the United States Forest Service. His address was illustrated by lantern slides. Along with the existence of available water-power resources he called urgent attention to the need of utilizing them. Among the sites pointed out where water-power development was practicable were those on Pitt River, Feather River and on Big Creek in California. By driving a 7-mile tunnel on Pitt River he considered possible the development of 175,000 horsepower. The Feather River region, by the driving of shorter tunnels, afforded the possible development of 195,000 horsepower; and the increase of the Big Creek system by 300,000 horsepower was considered possible and practicable. He urged the electrification of the mountain divisions of the railroads. H. A. Barre, of Southern California Edison Company, read a paper on "Power Resources of Southern California," and the "Joint Operation of Power Companies" was the subject of a paper by J. P. Jollyman of Pacific Gas & Electric Company, San Francisco.

In order to secure the necessary financial aid to quickly develop additional hydroelectric energy, it was suggested by R. H. Ballard of Southern California Edison Company that the War Finance Corporation be appealed to.

The extent of interconnecting transmission systems in California was taken up by L. S. Ready of the Railroad Commission of that state. In this connection he

Group at Convention of Pacific Coast Section, N. E. L. A.

suggested more attention to developing hydroelectric power where smaller units are practicable, instead of confining efforts to the projects of great magnitude.

The problem of financing hydroelectric projects, with the object of meeting the impending fuel-oil shortage, was discussed by P. M. Downing of Pacific Gas & Electric Company. He was followed by John Hood of the General Electric Company, who referred to the railroads as the greatest consumers of fuel oil, and urged no longer delay in beginning the electrification of their lines.

F. D. Nims of Washington Coast Utilities, Seattle, referred to the use of powdered coal and sawmill refuse. In the Pacific Northwest this practice is important in conserving fuel supplies.

S. J. Lisberger, of Pacific Gas & Electric Company, San Francisco, directed attention to the importance of practicing economy in hundreds of minor ways to help meet the fuel situation during the next year or two; as the securing of relief through hydroelectric development and railroad electrification could not be attained immediately.

This interesting discussion was participated in by many others, including Max Thelen, president of the California Railroad Commission; E. A. Quinn, San Joaquin Light & Power Company; E. R. Nethmore, Los Angeles Gas & Electric Corporation; C. O. Poole, Southern Sierras Power Company, Riverside; Edward Whaley, Northern California Power Company; W. M. Shepard, California-Oregon Power Company.

The second day's session of the Engineering Section was devoted largely to operating problems in the production and transmission of power, with special reference to economical practice. Along these lines J. A. Koontz of Great Western Power Company discussed means of extending the life and increasing the efficiency of water turbine units. H. H. Schoolfield, of Pacific Power & Light Company, Portland, described a plant for the utilization of power at a 60-foot fall in a canal system, having an induction motor running as a generator. L. M. Klauber, of San Diego Consolidated Gas & Electric Company, and C. O. Poole made reports on over-all losses in stations and lines.

Boiler-room economies were taken up by a number of speakers, all of whom gave practical suggestions. One of them was to give a bonus for economy in fuel feeding. The use of an automatic steam-pressure regulator for oil burners was suggested. The greater use of poor-grade coal was urged by F. D. Nims, Seattle, who showed how it could be raised in grade by powdering it.

How the Arizona Power Company, Prescott, operated a new steam plant to produce 354 kilowatt-hours per barrel of oil was explained by R. S. Mason. The increasing preference for steel conductors, instead of copper, was discussed by L. M. Klauber, who said the San Diego Consolidated Gas & Electric Company had over 300 miles of steel wires in use. The economy in adopting steel conductors consisted in their lower price and in the longer spacing between poles. There was further discussion on insulators and reinforced concrete butts for partly decayed wooden poles.

N. E. L. A. Officers Elected.

Election of officers of the Pacific Coast Section, N. E. L. A., resulted as follows:

President, Samuel Kahn, of Western States Gas & Electric Company, Stockton, Cal.

Vice-presidents, E. R. Davis, of Southern California Edison Company, Los Angeles, and A. G. Wishon, of San Joaquin Light & Power Company, Fresno.

Secretary, A. H. Halloran, of *Journal of Electricity*, San Francisco.

Treasurer, J. F. Pollard, of Sierra & San Francisco Power Company.

Executive committee: H. F. Jackson, H. A. Bostwick, J. B. Black, William Bauerhyte, George A. Campbell, D. E. Harris, Frank Somers, C. M. Einhart, S. Allen, H. E. Van Kuran, H. H. Jones and A. E. West.

Aside from the joint convention of the three organizations, the Electrical Supply Jobbers' Association and the California Association of Electrical Contractors and Dealers, each held a separate meeting, at which matters of particular concern to those branches of the industry were taken up.

SINGLE-PHASE FREIGHT LOCOMOTIVES IN GERMANY.

Three 1200-horsepower locomotives for handling freight traffic have recently been placed in service on the Magdeburg-Halle-Leipzig Railroad. This is one of the busiest railroads in central Germany. These locomotives were made by the Allgemeine Elektrizitats-Gesellschaft, and operate on single-phase energy at 13,500 volts and at a frequency of 16⅔. Each locomotive is equipped with two motors and is capable of going 30 miles an hour. Since the first three locomotives were placed in operation, 27 additional locomotives have been ordered.

Group at Convention of Pacific Coast Section, N. E. L. A.

ELECTRICAL JOBBERS HOLD SPRING MEETING.

Discuss Business Conditions and Contemplated Advertising Campaign at Hot Springs Convention.

That the general business situation in the electrical jobbing field is satisfactory, although somewhat unusual because of war conditions, was one of the interesting points brought out at the spring meeting of the Electrical Supply Jobbers' Association, held at the Homestead Hotel, Hot Springs, Va., May 21, 22 and 23. As a result of a questionnaire that was sent to jobbers in the Atlantic Division, it was disclosed that the business thus far done in 1918 is about the same in volume as for a similar period in 1917, although it is indicative of the present situation that the number of orders representing this volume is considerably less than last year.

The Atlantic Division and Central Division held separate meetings on Tuesday morning, which was followed by a general session of the entire organization on Tuesday afternoon. The discussion at the session of the Atlantic Division was presided over by Chairman E. C. Graham, of Washington, D. C., assisted by Secretary E. D. Tolles, of New York. A committee was appointed to consider the matter of a publicity campaign in the interests of the jobbers and another to take up the matter of increased prices inaugurated by the socket manufacturers. There was also some discussion regarding relations with central stations, contractors, etc., which was participated in by Messrs. Rockafellow, Robertson, Puzzini, Hockhasen, Frank Price, Oberlander, Little, and others.

At the general session the Committee on Universal Jobbers' Catalog was discharged with thanks, the sentiment being against the issuance of such a catalog.

One of the outstanding features of the general session was the strong sentiment in favor of conducting a publicity and advertising campaign through the electrical journals. The matter was discussed, at some length and it was voted to appoint a committee of three members to immediately prepare a budget for such advertising, the final disposition to be left with the executive committee.

A message of good wishes and good cheer was telegraphed to Judge Debevoise, counsel of the association, who was absent on account of illness. This session was presided over by Franklin Oberbagh, general secretary.

An enthusiastic session was held on Wednesday night at which the association voted in favor of closer relations with the electrical contractors. This action followed the report of a committee appointed to investigate this matter, which was presented by W. E. Robertson, of Buffalo.

A vote of thanks was tendered to the Society for Electrical Development and the electrical press for the offer extended to place the office facilities and services of their staffs at the disposal of the jobbers' publicity committee when appointed. This offer was made on behalf of the ELECTRICAL REVIEW by Charles W. Price, president.

A dozen golf balls presented to the association by the United States Rubber Company were auctioned for the benefit of the Red Cross fund and $1500 was enthusiastically raised.

In addition to 150 jobbers there were many prominent manufacturers in attendance, among whom were the following: E. B. Hatch, of the Johns-Pratt Company; James M. Perry, of the Johns-Manville Company; J. E. Way, of R. Thomas & Sons Company; A. D. Page, of the General Electric Company; George A. Hughes, of the Edison Electric Appliance Company, Inc.; A. L. Eustice, of the Economy Fuse & Manufacturing Company; F. S. Baldwin, of Pass & Seymour, Inc.; L. Nicholson, of the Westinghouse Electric & Manufacturing Company; L. P. Sawyer, of the National Lamp Works of General Electric Company; Charles M. Crowfoot, of the Crouse-Hinds Company; Elliott Reid, of the Westinghouse Lamp Company; A. Nelson Shreve, of the Electric Cable Company; W. W. Mumma, of the Robbins & Myers Company; F. V. Burton, of the Bryant Electric Company; L. L. Brastow, of the Trumbull Electric Manufacturing Company; W. E. Sprackling, of the Tubular Woven Fabric Company; R. K. Sheppard, of the Simplex Wire & Cable Company; Willard S. Sisson, of the D & W Fuse Company; H. B. Kirkland, of the American Conduit Manufacturing Company; H. H. Cudmore, of the Argus Lamp & Appliance Company; James M. Wakeman, of the Society for Electrical Development; James B. Olsen, Charles W. Price, Arthur Lockwood and A. Hall Berry.

A report of the closing sessions will be given in our next issue.

TELEPHONE EXTENSIONS FOR AVIATION AND MILITARY SERVICE.

An important extension to the Government telephone system which serves the several military camps situated adjacent to San Antonio, Texas, is to be made by the installation of equipment at Kelly Field, where about 30,000 aviators are in constant training. The construction of the new unit will be under the direction of the Signal Corps of the Southern Military Department, which has its headquarters at Fort Sam Houston. That to be established at Kelly Field will be the ten-position exchange, which will require about 25 operators. Girl operators are to be employed, as was done when the army switchboard was established at Fort Sam Houston. It will give capacity for 500 telephones. The department signal office will then have in charge the exchanges at Leon Springs, Remount Station No. 2, Camp John Wise, Brooks Field and Kelly Field, in addition to the big exchange at Fort Sam Houston, with its private branch exchanges at Engineer Depot, Base Hospital, Recruit Camp and repair shops. Kelly Field branch, to cost $40,000, is to be completed by August 15.

The Southwestern Telegraph & Telephone Company will also spend about $12,000 in the construction of trunk lines to Kelly Field.

OKLAHOMA COMPANY ADDS 1067 SMALL APPLIANCES TO ITS LINES.

H. H. Hermes, manager of the new-business department of the Oklahoma Gas & Electric Company, reports that during the month of April his department, in conjunction with the appliance dealers of the city, placed a total of 1067 appliances on the lines of the company, including 533 flatirons, 380 toasters, 258 vacuum cleaners, 27 curling irons, 22 washing machines, 16 grills, 12 sewing machines, 11 percolators and 8 heating pads. Forty-five already-built houses were wired during the month, adding 400 outlets. The appliances enumerated represent a load of 823 horsepower. Ninety-five per cent of the inhabitants of Moore, Okla., which was recently connected to the lines, are now served electrically by the company.

Operating

Carbon Loss Reduction in Ash Pit—Data on Meter Errors —New Power Contracts Secured by Public Service Company

REDUCING CARBON LOSS IN ASH PIT.

Arrangement of Ash Pits Under Chain Grate Stokers for Segregating Combustible from Ash.

The loss of carbon through the ash pit in both hand-fired and mechanically stoked furnaces is made up of two sources, namely, that contained in the ash and accompanying incomplete combustion and that due to coal that has fallen through the grate bars before it has had time to be burnt.

Without discussing the various types of stokers, it may suffice to say that with stokers of the underfeed type there is less chance of coal going to the ash pit unburned than with the overfeed and chain grate types of stokers because with the underfeed the green coal is forced up through the incandescent fire, giving full opportunity for the carbon and combustible to be consumed before it eventually falls down into the ash pit. On the other hand, a loss will occur with too rapid feeding of fuel to the fire, and a very real loss does occur when dumping clinker into the ash pit, because of the entrained carbon and unburned coal carried down into the ash pit.

With the chain grate type of stoker the grate bars travel and carry the coal along into the fire zone, as illustrated, continuing until the material on the grate is carried over into the ash pit, whether burned or not. When operating the chain grate at high ratings or rates of combustion care should be taken that grate speed is not too high, otherwise a high carbon loss in the ash pit may occur, if coal is fed to the fire faster than it can be consumed. With this type of stoker, however, the material passing to the pit is what is strictly called ash, whereas with stokers of the underfeed type it is clinker. There is no dumping of clinker with the chain grate, as can be understood by referring to Figs. 1 and 2, and thus the loss due to heat and unconsumed carbon carried over to the ash pit does not occur.

There is another loss with the chain grate, however, and that is due to coal falling through the grate bars before reaching the burning zone. The choice of grate bar, amount of wetting and size of coal seem to be the three important factors in deciding the amount of coal lost in this way, the latter of which has been found to vary widely in the last year due the fuel situation.

With coal at present prices, and economic values and the need for conserving it on personal as well as patriotic grounds it is particularly desirable and financially worth while to reduce to a minimum the amount of coal that is lost through the grate bars instead of reaching the fire zone where it would be consumed. The characteristics of the chain grate are such that a space exists under a portion of the grate into which coal falling through the bars before it reaches the fire can

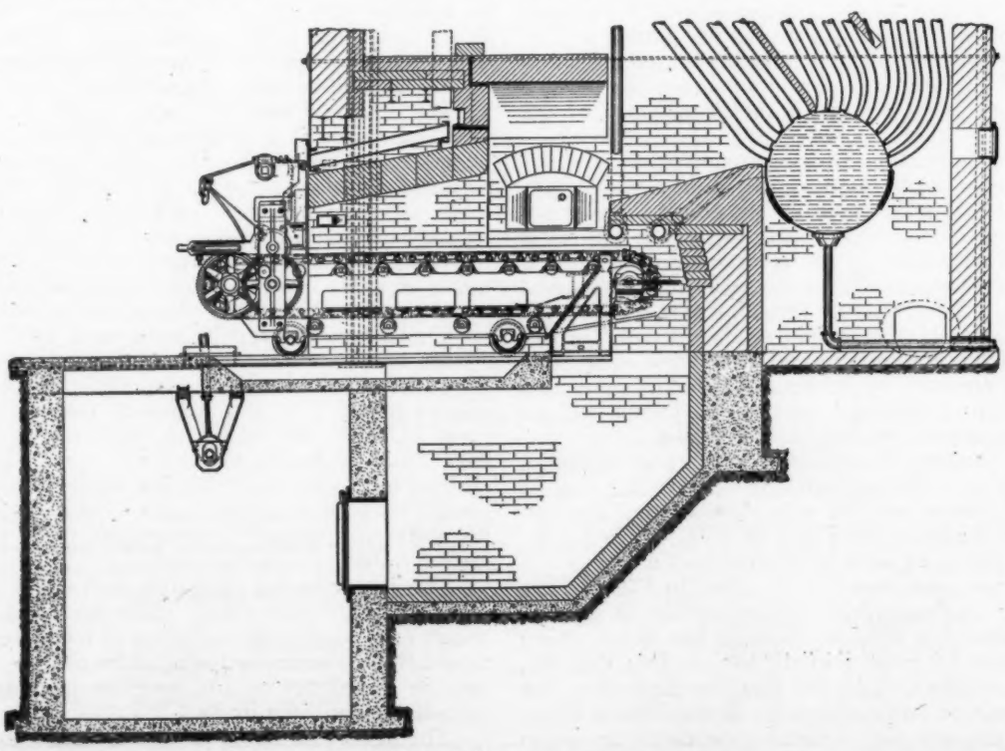


Fig. 1.—Green Chain Grate Stoker Where Coal Fallen Through Grate Must Be Raked Out Into Boiler Room Floor.

be retained and reclaimed. In this way a needless loss of unburned coal into the ash pit is prevented.

Fig. 1 illustrates one way of permitting the collection of coal that trickles through the bars of a chain grate stoker. A slight lowering of the floor level exists under the stoker into which coal, when it falls, will collect. It is then a simple matter to rake it out from time to time. It will be noticed that this space ceases at about the location where the grate bars are covered with incandescent ash, which means coal consumed.

Fig. 2 illustrates a different way of accomplishing the same purpose. In this case what is really a separate pit has been built under the grate into which the coal that falls through the grate deposits. This coal can be readily removed by the ash conveying system and used again. Another and separate chamber, it will be noticed, is used for receiving the ash that is rolled off the chain grate as it gradually moves round. This arrangement is very effective and yet economical of space, and enables loss of carbon in the ash pit due to variable coal sizes to be reduced to a minimum with the expenditure of a minimum of labor.

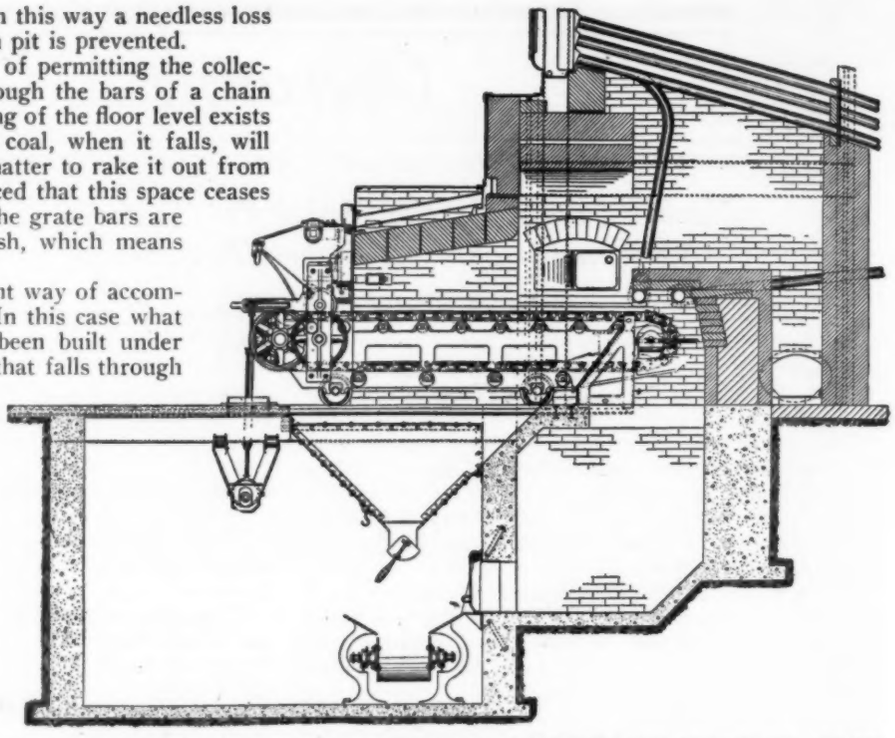


Fig. 2.—Green Chain Grate Stoker With Facilities for Reclaiming Coal Dropped Into Ash Pit Conveniently and Cheaply.

CHICAGO ATHLETIC CLUB CHANGES TO CENTRAL-STATION SERVICE.

Result of Cost Comparisons Between Central Station and Isolated Plant Operations.

The Commonwealth Edison Company has closed a contract with the Chicago Athletic Association to furnish energy for light and power, thus putting out of service the isolated plant in that institution. This is of especial interest, not so much on account of the size of the plant as by reason of the prominence of the club.

Existing generating equipment consists of two 150-kilowatt and 100-kilowatt units, with steam plant. These units are to be permanently shut down and superseded by Commonwealth Edison service. In order to get full advantage of the central-station service, a number of changes will be made in the mechanical equipment. The present variable-speed motors, of armature-control type, employed for driving refrigerating machines, ventilating fans and other equipment, are to be replaced by field-control motors; and two motor-driven, multi-stage, centrifugal pumps will be installed to operate the hydraulic elevators.

Before making these contracts, careful estimates were made showing comparisons between the cost of purchased power and the cost of operating the isolated plant, based on 1917 cost of coal, showing a remarkable saving in favor of central-station service.

With one exception, all the clubs in Chicago are now using Commonwealth Edison service, in spite of the fact that this class of business has heavy steam requirements 12 months in the year. This showing, therefore, speaks well for the central-station idea. The club has entered into a contract with the Illinois Maintenance Company for furnishing the necessary steam service on meter basis.

DATA ON METER ERRORS.

Interesting Statistics Compiled by Pacific Power & Light Company Indicate Improvement in Meter Accuracy in 1917 Over 1916.

The public service commissions of Oregon and Washington require that electrical meters be subjected to periodic tests by the central-station companies. Apart from this requirement, many companies test their meters irrespective of laws to safeguard the customers' as well as their own interests.

The Pacific Power & Light Company, Portland, Ore., has made it a practice to maintain records of meters tested, and places the meters in one of fifteen classes, depending upon the percentage error of the meter as found on test. These data are very interesting as shedding light upon what is to be expected, and moreover, emphasizing that the electrical watt-hour meter of today is an accurate instrument about which neither central station nor customer need really worry.

The meter test reports now used by the Pacific Power & Light Company have a column for meters found absolutely correct, and additional columns for meters found 1, 2, 3, 4, 5 and 10 per cent fast and slow. During the year 1917, 1010 meters out of a total of 8217 meters tested were found correct, according to the reports, while the number was actually greater because all meters tested were not recorded on the meter test blanks. During 1916 there were 7179 meters tested.

The accompanying tabulation shows that more than half the meters tested slow, while less than one-third tested fast, so that the variation in meter registration favors the customers rather than the utility. This fact may be mentioned to customers to advantage when complaints are being made.

The figures at the bottom of the table indicate the percentage limits, and the figures on the left-hand side

of the table indicate the percentage of meters tested that fell within those limits. The dotted line indicates results for 1916. In other words, 93 per cent of

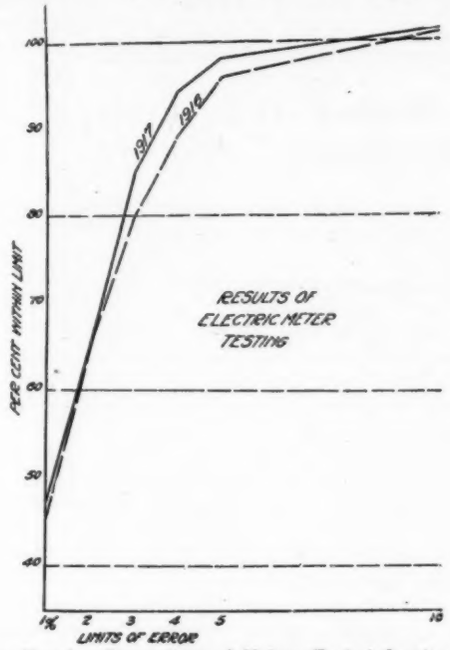


Diagram Showing Percentage of Meters Tested Coming Within Definite Limits of Accuracy.

all meters tested in 1917 were within 5 per cent of being correct and 91 per cent of the meters tested in 1916 were within 5 per cent of being correct. It is the company's aim to build up this curve so that it will keep drawing nearer the upper left-hand corner of the chart as much as possible. The ideal condition, of course, would be a straight line across the top of the chart, but this is impossible of achievement.

The Pacific Power & Light Company believes it good policy for the district manager to discuss the question of meter testing with customers, and it is particularly desirable to get in touch with instructors in various schools and request them to have classes in physics, natural science and domestic science come to its meter-testing rooms and see how the meters are actually gone over and adjusted if necessary.

NEW CONTRACTS SECURED BY PUBLIC SERVICE COMPANY.

The Chicago Heights office of the Public Service Company of Northern Illinois handles its service and electrical merchandising in a territory over a radius of 25 miles from that place. This division is under the superintendency of O. L. Hyatt. The increased power service of the company in the district represents additional loads taken on by existing plants, rather than in the matter of power sold to new industries. It is noted, however, that arrangements have been made to furnish power to the new plant of Twin Tube & Rubber Company, Chicago Heights, the amount of the load required not having been determined at this time. It is also noted that the new canning plant of Libby, McNeil & Libby, now under construction here, will require light and power.

The new high-tension, 33,000-volt line built by the Public Service Company from Chicago Heights to Kankakee, a distance of 40 miles, has been in service several months. This line ties in with substation No. 96 at Chicago Heights, and connects with substation No. 4 at Blue Island.

This company's electrical construction force is busy and has plenty of work ahead, which comprises some new wiring, but principally rewiring of residences and other buildings. The sale of appliances follows closely this electric wiring activity. The system recently inaugurated by this company of paying commissions to employees who can secure orders for appliances is working out successfully in the Chicago district.

SUMMARY OF ELECTRIC METERS TESTED IN 1917.

		SLOW								FAST						
	Total Tested	10% & Over	5% 10	4% 5	3% 4	2% 3	1% 2	0% 1	Correct	0% 1	1% 2	2% 3	3% 4	4% 5	5% 10	10% & Over
Yakima	534	11	9	8	6	15	49	16	108	40	150	61	32	10	16	3
Walla Walla	2022	94	90	86	175	218	288	532	206	135	67	68	31	29	22	1
Pasco	1164	20	22	12	31	95	164	167	114	164	164	96	45	35	23	12
Sunnyside	7	1					2	1		1		1	1			
White Salmon	23					4	3	16								
Pomeroy	109	1					16	71	3	15	2	1				
Prosser	2									1						1
Goldendale	408	3	4	13	28	66	86	67	0	75	45	13	8			
Dayton	35					2	3	13	14	1						2
Toppenish	524	8	9	5	12	47	50	115	53	99	46	39	24	7	10	
Total Washington	4828	138	114	124	252	447	661	998	498	531	474	279	141	81	71	19
Pendleton	576	21	50	101	172	103	25	0	17	3	1	26	27	19	11	
The Dalles	570	1	5	2	8	7	29	47	176	94	110	46	27	13	5	
Astoria	1938	52	25	12	5	679	93	289	311	285	21	63	54	24	13	12
Hood River	305				2	11	43	121	8	90	23	6	1			
Total Oregon	3389	74	80	115	187	800	190	457	512	472	155	141	109	56	29	12

Some report blanks do not contain a column for "Correct" meters, and in such cases meters testing correct are evenly distributed in 0-1% fast and slow columns.

Total meters tested, Oregon and Washington.....8,217

	Washington	Oregon
Percentage testing within 1% correct	41.9%	42.6%
Percentage testing within 2% correct	65.6%	52.7%
Percentage testing within 4% correct	88.7%	89.4%
Percentage testing slow	56.7%	56.3%
Percentage testing fast	33.0%	28.7%

Contracting-Construction

Motor-Starter Troubles—Soft-Face Hammer—Other Kinks —Developing Cost-Keeping Systems—Among Contractors

COMMON TROUBLES WITH MOTOR-STARTING DEVICES.

Simple But Frequently Neglected Features of Direct-Current and Alternating-Current Starters.

By T. H. Reardon.

The countless motor-starting devices now in use are quite sturdy and reliable pieces of apparatus. They require a certain amount of attention, however, especially when used in dusty or dirty places. Some of the common troubles that develop, particularly in severe service, are described and their remedies given in the following notes. In all such devices the contacts should be kept bright and clean for mechanical as well as for electrical reasons.

Direct-Current Starters.

In direct-current motor service the ordinary rheostat in which an arm moves over contacts arranged on the arc of a circle is the most convenient starting device. All such rheostats are provided with an electromagnet which holds the arm in place after it has been brought up to the last notch or full running position. This magnet loses its power if the current goes off the line and the arm flies back to the starting position. The arm is returned to the starting position by a spring, which is always acting in opposition to the pull of the magnet that tends to keep the arm in last-notch position as long as the magnet is energized. If the pull of the spring is too great, which sometimes occurs when an inexperienced man makes certain changes in the way of correcting things, the pull of the magnet will not be sufficient to hold the arm in place when it is brought up and the arm will fly back. Conversely, if the strength of the spring becomes reduced, which often happens when motors are placed in damp places, or worse still, where dampness and certain bleaching agents (such as chlorine and oxides of chlorine) act jointly in bringing about metallic deterioration in apparatus, steel springs will be found corroded to such an extent that they do not possess their original strength and elasticity. As a preventive measure, springs as well as all other metal parts exposed to corrosive action should receive a drop or two of a mineral oil or be slightly smeared with vaseline occasionally to prevent such deterioration.

The pull of the spring and the pull of the magnet are balanced against each other, but there are other conditions that must be taken into account in making adjustments.

After the current ceases to flow in the low-voltage release-magnet coils, which will not be until the motor comes to rest (the motor acting as a generator will maintain this current until the motor stops), the magnet will still exert a considerable pull on its armature due to the relatively large amount of residual magnetism that remains in the core of an electromagnet after the current has ceased to circulate and before the armature is pulled away from the magnet poles. An arm that will not fly back to starting point when the motor stops, if moved back by hand and then brought up again, will not stick. In certain cases, however, it may stick and when it does do so it is not due to any pull exerted by the magnet but it will probably be found that the sliding contact on the bottom of the arm bears so hard against the contacts that the strength of the spring is not sufficient to overcome this braking effect due to the friction of the shoe moving over the contacts.

Sometimes this friction effect may exist only on one contact, one contact standing higher than the rest, and if this particular contact happens to be next to the magnet, the movement of the arm will be retarded before the arm has a chance to acquire any momentum that would carry it back provided it once got started.

If the magnet pull due to residual magnetism after current circulation ceases should be responsible for the arm sticking after the motor stops (this will very rarely be the case, however), the keeper can be lightly tinned over with a soldering iron, thus placing a certain amount of reluctance in the magnetic circuit of the magnet and its keeper. A drop of oil occasionally on the stud on which the arm is pivoted will help in securing free movement.

Alternating-Current Starting Devices.

Compensators are generally used for starting alternating-current motors of the induction type when the motors are above 5 horsepower. Small motors are usually thrown directly on the line without any starting device and, although the starting current is four or five times greater than the normal current, the fluctuation, as a rule, is not serious enough to necessitate the use of a compensator. The compensator, being adapted for alternating-current work, differs from the rheostat in that it possesses not only some resistance but considerable reactance in damping current flow, while the rheostat possesses resistance only. Moreover, the rheostat is a step-by-step starting device; its arm is to be moved slowly over the contacts, while the compensator has but one step from starting to running and the handle should always be thrown promptly from one position to the other position.

The accompanying diagram shows the plan of the compensator as it is usually constructed. Six wires are brought to the rocker cylinder of the switch, which is moved by the switch handle. One wire is a feed or line wire, the wire next goes to the motor, the next wire is line and the next one motor again, etc. When the switch is thrown to the starting position, the six contacts on the switch cylinder meet six contacts on the starting block and the current from a line contact on the switch cylinder passes to the contact on the starting block through one coil of the reactance and back to the next contact on the switch cylinder, and thence to the motor.

When the handle is thrown to the running position, only three contacts on the switch cylinder make contact —these are the motor contacts on the switch cylinder and they meet three contacts on the running block,

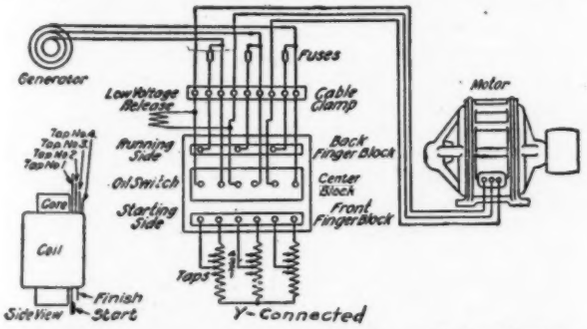
which contacts are directly connected to the line wires either through fuses or overload relays.

The line contacts on the switch cylinder, when the cylinder is thrown to running position, do not connect with anything—they stand clear or dead-ended. These contacts on the switch cylinder can be identified by using a lamp bank and making contact with them, the switch handle being in off position; a light will be obtained between line and line.

The first trouble to look for is burned or imperfect contacts. After taking the oil pan off the switch contacts can be inspected without any trouble.

If the contacts are burned or rough, they should be taken off and filed smooth or replaced with new ones. The same applies to the fingers that meet the contacts. The handle should be thrown to one position and then the fingers should be tried to see that they press firmly and evenly against the contacts on the switch cylinder. If they do not, throw the switch handle to off position and they can easily be bent inward sufficiently to make a firm contact. It will be well not to bend them too much at once as, if this is done, they will not slide over the switch cylinder contacts properly.

In regard to broken wires, the wires that are attached to the switch cylinder, six in number, are bent slightly every time that the switch handle is moved. These wires now and then break off. The other six



Connection Diagram of a Common Form of Motor-Starting Compensator.

wires that enter the compensator go to fixed immovable contacts and rarely cause trouble. To save labor, test everything out as far as possible with the lamp bank or some other way equally good, depending upon what kind of testing apparatus there is at hand.

It will be well to bear in mind that a ring obtained with a magneto or a light obtained with a lamp bank is not always conclusive. Instances are quite common where a wire or cable breaks inside of the insulation and there afterward remains a sheath of metallic oxide or smudge that will pass current enough to give a dull light on a lamp bank or a feeble ring on the magneto. When it is decided that a certain wire is broken, take out the two screws that hold that particular contact to the switch cylinder and pull down the terminal with the pliers.

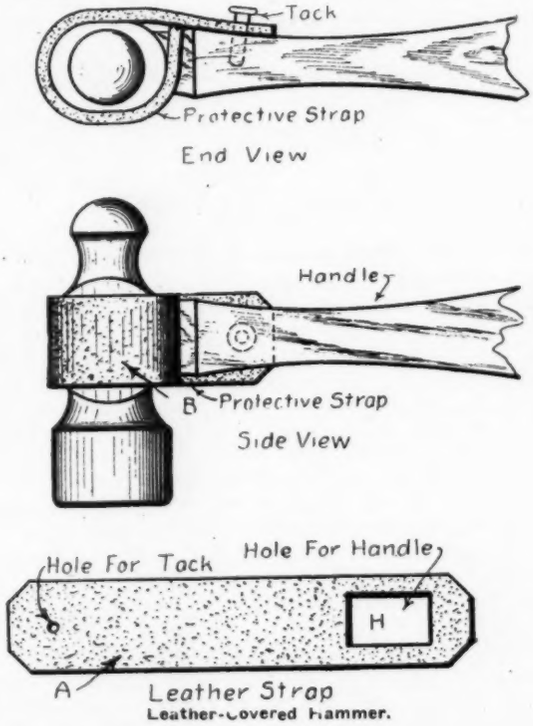
If the wire is intact, it will resist a strong pull. If the wire is broken and is held by the insulation, it will easily pull apart. If it pulls down through the switch cylinder sufficiently, attach a piece of new wire or cable to it and use it for a snake to draw the new wire into place, pulling at the top where the wires enter the compensator. If this does not work, draw the broken wire out at the top at all events and get a piece of stiff brass or steel wire, about No. 14 gauge, bend a smooth small loop on the end of it and pass it down from above; have a helper with a small hook wire watch for it and hook it above the switch cylinder so that it can be passed through the proper hole in the switch cylinder. This done, the terminal is soldered on at the lower wire and the terminal drawn back and wire spliced at the top of the compensator. It should always be the aim to make such a repair if possible without disassembling the parts of the compensator as such parts go back with difficulty.

It may be advisable or even necessary to use a wire slightly smaller than the original one in order to get through tight places. There will be no decided objection to doing this as the cross section of copper is always sufficiently ample to justify a slight reduction when such a thing is really necessary.

AN IMPROVISED SOFT-FACE HAMMER.

By L. C. Miller.

When it is necessary to pound certain metals, such as brass, nickeled or finished work, it is desirable to



Leather-Covered Hammer.

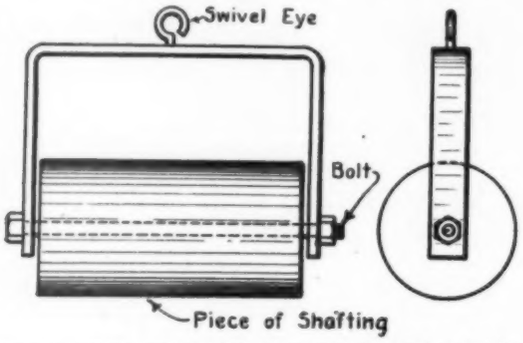
use a hammer which will not damage or mar the surface. Such a tool is called a "soft-face" hammer. Hammers with babbit-metal heads are regularly manufactured for this purpose and are very convenient. But an improvised tool can be assembled easily as suggested in the illustration. First a piece of leather belting is cut, as shown at *A*. Then this strip of leather is arranged on the hammer head as suggested at *B*. The hole *H* must be large enough so that the hammer handle will slip through it. The leather protective strip is fastened by driving a tack through the position *T* into the wooden handle. When pounding on objects that should not be marred, the blow is delivered with the side of the hammer head, which is protected with the leather.

WIRE OR LINE CARRIER.

By A. Gemmell.

Where wires have to be run over buildings with slanting roofs much danger and arduous work is in-

curred in climbing on the sloping surfaces, especially when wet or covered with ice. For reducing this work and hazard I used a simple carrier device with considerable success for many months. It is shown in the sketch herewith and is easily made. When you wish to let a wire, rope or line down, tie its end in the



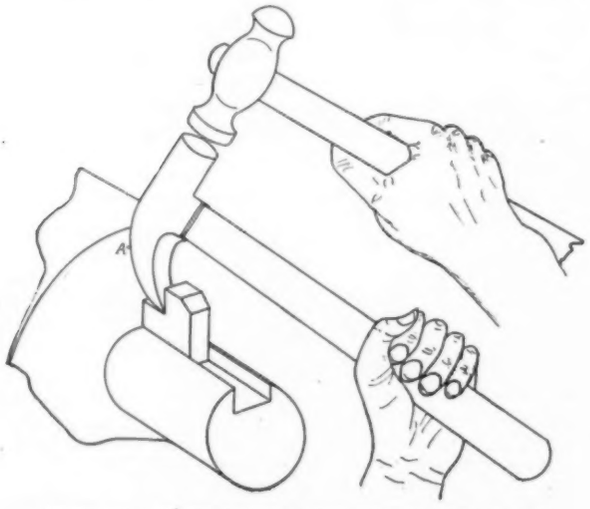
Simple Device for Carrying Wires Down Sloping Roofs.

swivel eye of the device. The weight and easy turning of the roller will carry the wire down easily. You will find it better than throwing or twitching the wire when it gets caught somehow.

SIMPLE KEY JIMMY.

By Charles H. Willey.

The sketch herewith shows a rather odd tool for removing keys of flywheels, pulleys, gearwheels, etc. It has proven a very useful device in our plant. The writer has dubbed it a "key jimmy." It is made from machine steel at the forge and used, as illustrated, by pulling or pushing up on the handle, at the same time hitting jarring blows on the nub or boss. This usually



Jimmy for Extracting Keys From Pulleys and the Like.

starts even the most stubborn key. As the key is moved out, blocking is used at the point *A* behind the tool. In emergency a claw hammer may be used in place of the special jimmy.

DEVELOPING A COST-KEEPING SYSTEM.

John A. Piepkorn, state secretary of the Wisconsin State Association of Electrical Contractors and Dealers, has sent out a letter to members on Cost Keeping, from which we extract the following interesting matter:

Cost is defined as the amount paid, or charged for anything; loss of any kind, expenditures, outlay as of money, time, labor. The equivalent may be in the form of money paid for material or for labor, or for some one of the many kinds of expenses or loss that exists in every contracting, retail or wholesale business. Cost therefore consists of three elements, viz., Material, Labor, Expenses.

The purpose of conducting a business of any kind is to make money, and the only way to make money is to sell something for more than it costs. The first essential to ascertain, therefore, is the cost of an article or job you offer for sale. If you intend to be a successful business man, it becomes your duty to keep a systematic record of your cost.

For the retailer and wholesaler it is a comparatively easy matter to ascertain the cost of any article, for the reason that the manufacturer establishes the price by either quoting in advance or by invoicing to the jobber, and the cost of the same article to the retailer is established in the same manner; in both cases the value of material, labor, expense required to produce the article is determined by the manufacturer. The only element of uncertainty, and which is added before the article will be offered for sale, is overhead expense, which the jobber adds to the cost of the article before he establishes his selling price to the dealer, and the dealer adds to his cost before he offers it for sale to the consumer. To them the only element of uncertainty is Expense.

The contractor, however, faces a more difficult situation when he attempts to establish the cost of a job he wishes to sell. For the contractor, all three elements are a matter of uncertainty. It is, therefore, a mistaken idea, with which some people are possessed, that a successful contracting business requires a man of less intelligence than is necessary to successfully conduct a wholesale or retail business. In fact, the contrary is quite true.

The contractor must estimate. He cannot get the cost from the invoice of jobber or manufacturer, the material and labor required to do a certain piece of work, and the only safe way to reduce the uncertainty of the elements of material and labor is to have a complete Cost Keeping System on every job he does. This will enable him to make intelligent comparison and analyze differences. To do this successfully he must have a uniform system to reflect differences in conditions and classifications. While the primary purpose of a cost system may be, and is, to determine the cost of material and labor of similar jobs under similar conditions for the purpose of estimating in advance the cost of a similar job, the contractor should not lose sight of the fact that the element of Overhead Expense should receive his most careful consideration.

AMONG THE CONTRACTORS.

Peterson Electric Company, Madison, Wis., has moved into larger quarters at 113 Washington Building, where appliances and fixtures are being advantageously displayed. A good-sized repair shop occupies space in the rear part.

The Lew Tisdale Company, Memphis, Tenn., is wiring and installing electrical equipment in the handsome residence of J. S. Robinson, 1860 Central avenue, in that city. The company is also furnishing additional electrical equipment for the Southern Motor Car Company, 627 Monroe avenue, Memphis.

QUESTIONS AND ANSWERS

All readers are invited to submit questions and answers to this department. Anonymous communications will not be considered. Questions should relate to electrical matters of any kind. Answers contributed by readers should be submitted preferably within eight days of the date of publication of the question and should be limited, if possible, to 300 words. Payment will be made for all answers published.

Questions.

No. 428.—CONDENSER FOR MOTOR STARTING.—Can the starting current of a squirrel-cage induction motor be reduced by using a condenser when the compensator does not keep it from becoming so large that it is objectionable? What way would it be connected and how large would it need to be for a 100-horsepower, three-phase, 440-volt, 25-cycle motor?—J. A. B., Fort Dodge, Iowa.

No. 429.—PLUNGER MAGNET.—Information is desired on the construction of a solenoid or plunger magnet to operate on 16 volts and 1.5 amperes on a 60-cycle circuit almost continuously. The stroke is to be about 1 inch, if possible, and with all the pull that we may get. The pull will close a connection heavy enough to carry 5 amperes on a 110-volt circuit. The size of the magnet is not of any consequence.—F. H. O., Chester, Pa.

Answers.

No. 421.—WIRING FOR FARM-LIGHTING PLANTS.—Where the common 32-volt farm-lighting plants are installed, is the wiring usually done by a reputable electrical contractor from the nearest town, or by the farmer himself? Is it customary for the manufacturers of such plants to recommend first-class wiring of the premises by a competent contractor; do they give suggestions as to how the wiring should be done, or do they treat it as a matter of no concern of theirs or even minimize its importance, thus giving the impression that practically anything will do?—T. H. R., Guthrie, Okla.

I have installed quite a large number of 32-volt farm-lighting plants in this and other localities and I have installed all wiring strictly according to Class C rules of the Code. I allow a maximum of 200 watts per cutout, and figure the size of wire according to the amperes of the low-voltage load. I allow 2 per cent to 3 per cent loss.

There has been no work done by the farmer around here. All companies that I know of recommend that the work be done by an experienced electrician, but all tend to give the impression that the wiring is easily done. I know of but two companies that give out a little book giving instructions for the farmer to do his own work.

My experience in this work is that the wiring cannot be done too well. I know of a number of electricians who pay no attention to the low voltage when installing this class of work, but do the wiring as if for 110 volts. On a large job it is hard for an honest contractor to compete with such competition. The farmer knows nothing about the work, so looks mostly at the cost.

I intend to do this class of work entirely the coming year and I firmly believe I cannot do the work too well.—R. W. M., Mabel, Minn.

No. 422.—MOTOR-STARTING TROUBLE.—A plant supplying a small town with power and light contains the following equipment: Two 37½-horsepower high-speed engines, running 350 revolutions per minute and driving two belt-driven 20-kilowatt, 60-cycle, 2300-volt, 1800 revolutions per minute generators. Two exciters belted to the generators give 90 volts. The switchboard is equipped with voltmeters, ammeters, rheostats, but no regulators for the machines, voltage regulation being done by hand. Primary lines are of No. 8 copper. At about 500 feet from the power house the first transformer of a bank of three 7½-kilowatt units connected in closed delta is taken off; they supply 220-volt power to an elevator motor 1000 feet distant from the power house. The next transformer is 150 feet farther on toward the elevator and the last one in the bank is 250 feet from the elevator. Secondary lines are No. 8 copper clear to the motor The motor is 5-horsepower squirrel cage with no starting device. When attempt is made to start the motor without load and with no friction on bearings it pulls the line voltage down from 220 to around 100 volts and holds at this point for about three seconds, when it begins to build up, and at the end of ten seconds returns to 220. The motor will then be running. It not only pulls down the secondary voltage but also the primary voltage so that the entire system is affected. The engine also shows an appreciable decrease in speed, but as no proper speed indicator is available, it is impossible to tell how great is this drop in speed. The engine flywheels weigh about 250 pounds each and we surmised that they are so light as to be unable to withstand the sudden jar of the motor being thrown on. The motor will pull 5 horsepower when up to speed but will not start itself. We do not know where the trouble is located, on the line, in the power house or at the motor.—B. A., Watertown, S. D.

[For Answers *A* and *B* see ELECTRICAL REVIEW of April 27, 1918.]

Answer C.—Having had some experience with squirrel-cage motors located where the capacity of the generating equipment is very limited, I submit the following suggestions with reference to question No. 422. The elevator machinery should be so arranged that the motor can at all times be started without load, and the load thrown on by means of a friction clutch, or other device, after motor has come up to speed. If the transformers mentioned in the question are also used to carry a lighting load, and are in the most advantageous location for that purpose, they should be left where they are, and the No. 8 secondary to the motor replaced with No. 4 wires. The transformers need not be any nearer together than they are, if the secondary wires are made large enough. The installation of a bank of transformers near the motor, for no other purpose than to furnish current for the motor, would not only be more expensive than replacing the No. 8 wires with No. 4, but the iron loss in the transformers would amount to more than 100 watts. This loss would be constant, load or no load. As a rule, small elevators run their machinery only a small part of the time, and if this is true of the one referred to, the transformer loss would be large in proportion to the power used. Owing to the large starting current required by this motor, in proportion to the generating capacity of the plant, a considerable drop in voltage over the entire system is unavoidable. The best that can be done is to give the motor a chance to come up to speed as quickly as possible.—W. F. H., Gordon, Nebr.

Answer D.—The trouble experienced with this installation may be due to one or more of the following causes: The secondaries are barely large enough to take care of the drop of voltage due to the running current of the motor assuming an allowable loss of 5 volts. This is figured on the basis of copper loss alone, so that when the question of power-factor, reactance and other losses peculiar to alternating-current installations are considered, as well as the fact that the starting current may well be over twice the normal running current it is at once apparent that larger secondaries are necessary. The transformer bank in itself is more than ample if the motor is all the load that is imposed upon it, but from the somewhat unusual spacing of the units it is reasonable to assume that other installations are fed single-phase from one or more of the individual transformers. This in itself would possibly lead to the overloading of one or two of the transformers, which would cause a serious state of unbalance and lead to different voltages being imposed upon the various phases. The fact of the motor not

starting well even without load would point to one phase being open, but may also be due to the greatly decreased torque owing to the excessive drop of voltage as soon as the motor is connected to the line. No data are given in regard to the load on the system outside of the transformer bank mentioned, so that it is impossible to say whether the trouble is in either the primaries or the power house. From the facts submitted, however, it is almost a certainty that, if the transformers are not overloaded, the secondaries are of proper cross-section, the three phases are intact through the motor and no overload is imposed at starting, the trouble will disappear.—J. S., Cumberland, B. C., Canada.

No. 424.—LIGHTNING RODS FOR FARMS.—In advancing the well-known reasons for rodding farm barns and similar exposed rural structures, what actual data are available as showing conclusively the wisdom or necessity of installing lightning arresters? What data are there showing the actual reduction of lightning and fire losses due directly to rodding buildings?—M. G. McG., Fargo, N. D.

Answer A.—No actual data are available to show the reduction of lightning and fire losses due to the installation of lightning rods, but the immunity of tall office buildings which are built with steel frames shows conclusively that a metallic framework is an effective protection against lightning. The tall office buildings are frequently struck, but the discharge always passes harmlessly to ground through the steel frame, and these buildings are the safest possible refuge in a storm. Isolated houses and barns in the country are very liable to be struck but the resultant danger is much reduced if the building has a system of metal water or gas piping running from the roof to the ground.

Lightning rods, to be effective, should run from all the prominent points, such as chimneys, gables, etc., and should always follow the shortest path to ground, as lightning will not follow sharp turns. The rods should stand at least 3 feet above the part to be protected, and greater protection is assured if they are higher. Care must be taken that the rod is strong enough and well protected, especially for some 8 feet above the ground, so that it will not be broken. A gap or break in the rod is fatal and almost worse than no rod at all. Many installations are of little value on account of poor ground connections. In the absence of a water-pipe system entering the building underground, it is advisable to dig a pit about 3 feet in diameter and deep enough to reach permanent moisture for the ground plate; or a gas pipe may be driven 6 or 8 feet into the ground and the ground wire put down into it and secured by pouring in lead. The chances of a building being struck depend largely on its location and its height, and while lightning rods draw the discharge, they provide a safe path to ground, and if the installation is in accordance with the known requirements, it will be a good investment and justified as much as any other form of insurance.—C. H. H., Swampscott, Mass.

Answer B.—There are two ways in which the advantage of lightning rods for farms, barns and agricultural buildings can be determined. One is by comparing the number of structures struck, burnt and destroyed with rods with those without rods. The other way is to compare the rates for insurance upon rodded and unrodded structures. The latter, the insurance rate, is based upon the former, of course, but while the former appeals mostly to the insurance interests it is the latter that forcibly appeals to the farmer whose buildings it is desired to rod.

Efficiency of Lightning Rods.—Many surveys have been made to determine the efficiency of lightning rods on farms. One survey made in Ontario, Canada, showed that of every 200 buildings insured, 42 were rodded, or 21 per cent. Out of every 200 buildings struck by lightning three were rodded buildings, whereas had the rods been of no benefit one would have expected 42 to be struck. In another case, reported by 18 insurance companies, it was found that out of 7000 buildings not rodded, 37 were struck by lighting, whereas out of 7000 rodded farms only two were struck; moreover, these latter were only damaged, whereas those not rodded were set on fire. In other words, the unrodded building was shown to be 18½ times as likely to be struck by lightning as the rodded building. The efficiency of the rods in the above is about 94½ per cent. In another instance, based on reports of 40 insurance companies, of which 16 were very complete, it was shown that total claims paid for lightning damage amounted to $40,904.53 on 193 buildings, of which 36 were burned. Of these damaged and destroyed buildings only eight were rodded and were not destroyed but only damaged. The claims for damages on these rodded buildings amounted to $57.64. The efficiency of the lightning rods in this case was 99.5 per cent, and had the rods been useless the loss would have been $10,715.98 for 50 claims instead of eight claims, with a saving chargeable to rodding of $10,658.34. Taking the reports of 40 companies paying claims on 621 structures struck to the amount of $113,459.89, 110 of which were burnt, it was found that only 16 rodded buildings were struck with a loss of $3,917.09, whereas had none of the rodded buildings been rodded it was to be expected that there would be 163 strokes instead of 16 and a loss of about $29,726. Some data of rodding in Iowa are of interest. For some 55 insurance companies paying claims for damage by lightning between the years 1905 and 1912 claims paid on rodded buildings amounted to $4,464.30, whilst on unrodded buildings they totaled $341,065.32, the average on rodded structures being $10.15, on unrodded $775.15, equivalent to $1 on a rodded building as for $76 on every unrodded one. About 50 per cent of the risks carried by these companies were rodded. In Michigan the Farmers' Mutual Lightning Protected Insurance Company, insuring only rodded buildings, between 1909 and 1912 did a business for the four years amounting to $55,172,075 and paid claims of only $32 for lightning damage, all of which were stated to be due to defective rodding. The Patrons' Mutual Fire Insurance Company, insuring both rodded and unrodded buildings in the years 1909 to 1912 carried a risk of $59,566,272 and paid lightning-damage claims to the amount of $32,268.78, or 1008 times as much as the company carrying risks only on rodded structures! About 20 per cent of the risks were rodded, which shows that for damage on rodded buildings of $1, that on unrodded buildings would be $1168.

Effect of Rodding on Insurance Rates.—The effect of rodding has been so pronounced that many insurance companies only insure rodded structures; others maintain different risk schedules for rodded and unrodded buildings. For example, one company some years ago charged $3.33 per $1000 on an unrodded building and $2 for one that was rodded. As another example, the Iowa Protected Mutual, a company only insuring rodded buildings, did not pay a single claim for damage due to lightning in six years. Its assessment per $1000 was $8, whereas another company doing business in the same territory and carrying risks on both rodded and unrodded buildings charged $14.50 per $1000, a difference of 44.8 per cent in favor

of the company carrying only rodded risks. In another state, the average of five companies carrying both rodded and unrodded structures gives a rate of $2.96 per $1000 on unrodded and $1.89 on rodded buildings, showing a rate in favor of the rodded buildings of 36½ per cent.

Nothing has been said about the lightning rod, whether it prevents lightning strokes or merely reduces their effect. But what has been said indicates, on a dollar-and-cent basis, that it pays to rod the farm, and that the insurance interests at least recognize the value of the lightning rod. The above premiums are not necessarily those existing today, since prices in all commodities.—B. W., Chicago, Ill.

No. 425.—Copper-Covered Wire for Naval Use.—Is copper-covered wire used upon ships, in the navy especially, for electrical purposes, where strength is required, such as for antennae of wireless outfits? The writer has heard it stated that copper-covered wire is unable to stand up in salt-laden atmospheres, and where corrosive fumes from the stacks of battleships have to be withstood. Is this correct, and what metal supplants copper for this class of service?—P. M. C., San Francisco, Cal.

Answer A.—Copper-clad steel wire made by the Page Woven Wire Fence Company, trade name, "Copper Weld," and that made by the Standard Underground Cable Company, known as "Colonial Copper Clad" or "CCC," is able to withstand salt-laden atmospheres and is now in use quite extensively in the Atlantic Coast towns for telegraph and telephone purposes. For wireless, a nonmagnetic wire is demanded and for all purposes on both land and sea a silicon or phosphor-bronze wire, such as the "Phono-Electric" wire made by the Bridgeport Brass Company, is used. —H. E. W., Chicago, Ill.

Answer B.—The ships of the navy use seven-strand phosphor-bronze wire for the antennae in connection with the wireless equipments. This metal has also been used in other electrical fittings where exposed to salt atmospheres with entire success, as also has aluminum. In fact, aluminum has many advantages for use in the construction of all electrical marine instruments and fittings of every description. It gives success also when used with wireless for antennae in quite a number of equipments known to myself.—F. F. H., Milwaukee, Wis.

No. 426.—Inclosed Switch.—Is there any warrant for an inspector insisting on use of an ironclad or inclosed knife switch for a three-phase, 220-volt, induction motor where a careful operator is always close at hand and no one else is permitted to come near the switch, which is on a post close to a special machine under the care of the operator?—H. S. C., St. Louis, Mo.

Answer A.—Inclosed or ironclad knife switches are signs of the times and an inspector is frequently justified in calling for these from a safety-first point of view. There was a time, and it was not long since, when almost any kind of wiring or switch was considered good enough, but now motors are usually furnished with conduit terminal boxes for bringing out the leads, and the wiring is inclosed in a metal conduit; it is therefore not unreasonable to insist that the main switch should also be protected. Inclosed switches of correct design make the accidental closing of the circuit impossible, as the handle must be pulled out to start the motor and pushed in to stop; the operator is also protected against shock or burn from a possible arc. These switches also reduce fire risks considerably and the use of such apparatus will ultimately result in a reduction of insurance rates. It must also be remembered that an inspector cannot assume that any operator is more capable or careful than another, and even though a careful operator is employed at present, there is no guarantee that the same condition will exist indefinitely. The trend of the times is toward the perfection of all apparatus and to rely as little as possible on such a variable factor as human nature.—C. H. H., Swampscott, Mass.

Answer B.—There is nothing in the National Electrical Code which makes the practice of inclosing knife switches compulsory unless the swtich is exposed to mechanical injury, or is likely to ignite inflammable material. However, due to the rapid growth of conduit wiring and the constantly increasing practice of making all apparatus absolutely safe, one seldom sees an exposed knife switch in a modern plant. In fact, the present practice is to install knife switches in metal boxes which allow the switch to be operated when the box is locked. These simple protective devices are cheap compared to the expense incurred from possible injuries.—W. H. K., Kankakee, Ill.

Answer C.—There is always danger that the operator engrossed in his routine will attempt at some time to operate the switch without looking directly at it. This has happened so often to skilled men and others that safety-first, that is, inclosed switches are the order in all plants and are especially desirable for switches located adjacent to machines.—H. E. W., Chicago, Ill.

Answer D.—The inspector can demand an inclosed switch unless its operation is assumed to be under expert supervision. To fulfill this condition, the switch would be accessible only to a qualified expert, one of whose specific duties would be the operation of it and who was familiar with the consequences of its operation. In general, this condition would obtain in an engine room, power house, etc., but as a rule not at an isolated machine such as you describe, regardless of the fact that said machine has an operator in attendance. The inspector's ruling may have been further influenced by "danger of mechanical injury, presence of easily ignitable materials, etc." as covered by Rule 19*b*, National Electrical Code, and also as per Rule 327 on "Guarding live parts of switches, etc.," National Electrical Safety Code issued by the Bureau of Standards. The present-day practice tends to the use of safety inclosed switches wherever possible and complete lines have been developed and marketed. Small sizes employing specially designed snap switches approved for use on voltages up to and including 440 volts alternating current are universally used in textile work. Many of these are adapted for conduit fittings, as are also those of the knife type, thus making a compact and neat appearance far superior in all respects than are open knife switches.—M. K., Passaic, N. J.

Regulation of Street Series Lamps.—On the evening of May 27 an illustrated paper on the "Regulation of Street Series Lamps" will be presented by F. A. Vaughn, of Milwaukee, Wis., at a joint meeting to be held in the rooms of the Western Society of Engineers, Chicago, by the Chicago Sections of the American Institute of Electrical Engineers and the Illuminating Engineering Society, and the Electrical Section of the Western Society of Engineers. Mr. Vaughn has given special study to this subject in connection with his design of the new street-lighting system of Milwaukee.

The Lighting of London.—The London "Safety First" Council has suggested to the lighting authorities in the Greater London area that after the war the use of appliances should be encouraged to provide diffused street illumination in substitution for what is described as the "glaring lighting" which prevailed before the outbreak of war.

New Appliances

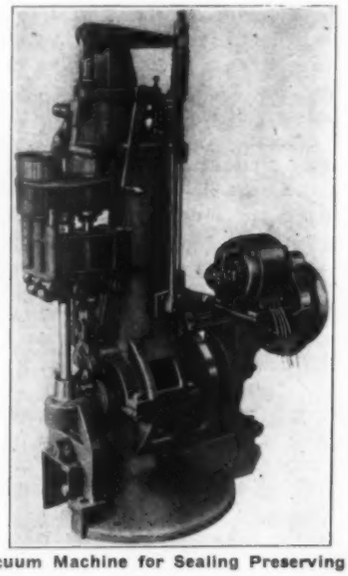
Vacuum Sealer—Hand Magnet—Electric Dubber—Rider Multifilament Tungsten Lamp—Portable Air Compressors

MOTOR-OPERATED PISTON VACUUM MACHINE.

The piston vacuum machine illustrated, which is used by canners and preservers, combines a tumbler sealing machine and a vacuum pump in one simple unit requiring only a ¾-horsepower Westinghouse motor to operate it.

It is claimed that an ordinary operator can seal as many as 50 tumblers a minute with this machine with less effort than formerly because of the construction which enables him to perform the work of unloading and loading one pocket while the machine removes the air from the other pocket and seals it. The degree of vacuum desired in each package can be regulated instantly. Broken tumblers are reduced to a minimum, since the sealing strain is applied through compensating springs which seal each jar alike, although one may be larger than the other. The variation is taken up in the spring. Changes from one size to another can be made easily in two or three minutes.

This machine is made in two types for sealing tumblers from 2½ to 6 inches in height. The two-pocket type is used for dry or pastry products, and the four-pocket type for liquid or semi-liquid products



Electric Vacuum Machine for Sealing Preserving Tumblers.

which are apt to spill or splash. Either type is arranged to give three speeds, as described. It is manufactured by the Anchor Cap & Closure Corporation, Brooklyn, N. Y.

NEW DESIGN OF HAND MAGNET.

The C-H hand magnet which has been used for the past decade has recently been improved. The magnetic coils, switch and connections are now entirely covered by two aluminum castings. The upper aluminum casting forms the yoke cover, switch cover and handle supports. The lower casting covers the coils and leaves only the soft-iron poles projecting. The circuit to the magnetic coils is closed and opened by means of a large trigger, mounted under the handle in the handle support, which operates a strong quick make-and-break switch concealed in the upper aluminum cover. The trigger is operated by the index

Newly Redesigned Hand Magnet.

finger; pulling it toward the handle closes the switch. When slightly released the switch does not open, but when fully released the switch opens with a quick break.

This magnet has been profitably used in many different kinds of plants, including metal dealers, smelters and refiners, iron and brass foundries, machinists, paint manufacturers, chemical work, paper mills, fertilizer plants, flour mills, enamelers, tinners, electroplaters, malt houses, hardware dealers, plumbing manufacturers, garages, fixture manufacturers, mathematical instrument makers and shipping departments. In the manufacture of spelter solder the magnets are used to remove copper-coated iron and steel wire. The least bit of this foreign material would "throw off" a heat. Suspended with its two poles immersed in the liquid, the magnet will attract to itself any particles of iron or steel in the tubs in which paints, glazes, chemicals, etc., are mixed. In the shipping department many hundred nails are recovered with it from the sweepings. It is useful in handling hot or awkwardly shaped castings, cleaning molding sand and for dipping can covers.

The magnet is manufactured by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., and is furnished with five feet reinforced cord and a standard C-H separable attachment plug.

ELECTRIC DUBBING MACHINE FOR WOODEN SHIPS.

The Pacific Northwest is turning out a large number of wooden ships aside from an unusual amount of steel tonnage. As the demand becomes more insistent, ingenuity is being called into play to add all possible speed.

Gray & Barash, Seattle, Wash., electrical engineers and machinists conducting the largest business of their

kind on the Pacific Coast, have perfected and are now turning out an electric mechanism that the builder of wooden ships finds necessary if the proper degree of

Electrically Driven Dubbing Machine to Facilitate Fitting of Wooden Ships.

speed is to be maintained. This is an electric dubber used for fairing the inside and outside of wooden ships in frame before the planking can be placed on the exterior of the hull and the sealing on the inside of the hull. It is claimed for the mechanism that it will do the work of 20 men and can be operated by one man. This work was formerly done with the adz, and there is still 20 to 30 per cent of the work that must be done in this way.

The electric dubber planes off the outer and inner sides of the frames so that a smooth and even surface is presented for the planking and sealing. When done with the adz a surface of 60 to 75 per cent fair or even is secured but the electric dubber produces a surface of 100 per cent even, and according to experts, increases the strength of the hull 10 per cent.

The device operates on two 8-pound rails with 150 feet of track. The rails stand 4 feet apart and are attached to the frames by lag screws. Six hundred square feet of surface can be planed without changing the rails. It can be adjusted to the curves of the vessel's hull with but little delay. The carriage moves forward on the rails with the pressure of the operator's hand. The knives or planes are set in an eighth-inch cutter head and the operation is by an electric motor, the cutter head removing the differences in the surfaces of the frames. A light high-speed 6-horsepower motor is used. Records already made in the work range from 1000 to 1500 square feet in 8 hours.

The United States Shipping Board is favorably impressed with the mechanism and has already placed it on the work in two wooden shipyards of the Northwest, taken over some time ago. Numerous orders are being placed for it by the yards on both coasts and it is now in use in three of the largest private yards.

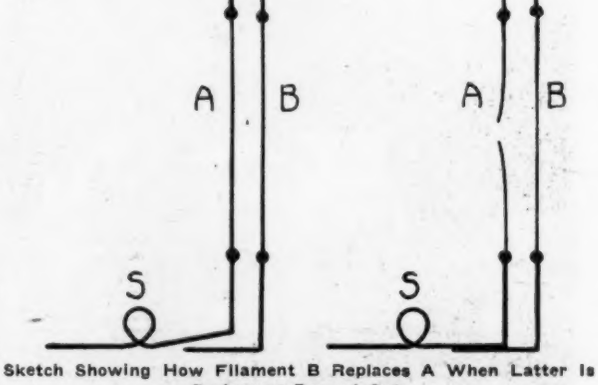
RIDER MULTIFILAMENT INCANDESCENT LAMP.

T. B. Rider, a scientist at Los Angeles, Cal., has recently perfected an incandescent lamp, the filaments of which are so arranged that in case one of them breaks or burns out, another filament of the same candlepower comes to light by an automatic process. In addition to this, Mr. Rider has equipped the lamp with auxiliary filaments, which can be turned on by pulling on a chain placed in the socket of the lamp. If it is desired to increase the light, all that is necessary is to pull the chain and, if the lamp is burning, say, at 100 candlepower, one gets at once 200 candlepower without the necessity of turning on another lamp. Briefly, in order to get more light in the ordinary way it is necessary to turn on more lamps, whereas, one needs but to pull a chain in the new way to get double the amount of light.

In the Rider lamp there are 12 filament sections in the bulb; these are of 25 candlepower each. Four are to be lighted at once when the lamp is turned on, and the next four spring into life in sections of 25 candlepower each time as one of the four originals is lost. Thus, if the life of the ordinary lamp is, say, 1000 hours, it will be 2000 hours with the automatic arrangement. The lamp is always furnishing 100 candlepower until the last filament of the substitute set is in service and even then there is the third or auxiliary set of filaments; thus the life of this lamp is just three times the life of the ordinary lamp. Each filament burns independently of the others. For instance, one of the filaments may burn out without affecting any of the others.

When all of the first eight filaments burn out, the third or auxiliary set of four filaments can be turned on, which will still give 100 candlepower. The third set of filaments is arranged in separate units, so that these will continue to burn until the last one is burned out. Consequently, when the lamp is on the last filament, burning only at 25 candlepower, one still can use it as a night light.

The accompanying sketch shows roughly how each of the four original filaments *A*, and its adjoining substitute *B*, is mounted. Each filament *A* in circuit when the lamp is first turned on is fastened at its lower end to a spring *S*. When a filament burns out or breaks, this spring instantly drops down and touches a wire that is connected with the second filament *B*. This



Sketch Showing How Filament B Replaces A When Latter Is Broken or Burned Out.

completes the circuit through the second filament, causing the latter to replace the original instantly. This is shown at the right-hand side of the sketch.

THE USE OF PORTABLE, MOTOR-DRIVEN AIR COMPRESSORS.

The use of portable, motor-driven air compressors in mines and shops serves to illustrate the adaptability of electric power to almost any industrial requirement. Under circumstances where compressors of small capacity are needed in work that requires a changing of base several times a day the economy and flexibility of the portable unit is self-evident.

One of the accompanying illustrations represents a portable outfit in a shipyard where compressed air is used for riveting and performing other pneumatic work. This unit, which is composed of an air compressor of 125 cubic feet capacity, and a Westinghouse 20-horsepower motor, rests upon a bedplate mounted upon trucks. It is moved over industrial tracks to various points in the yard to apply compressed air to any tools required. The motor is connected to the compressor shaft by pinion and gear; that is, the motor pinion engages an internal gear on the compressor flywheel. Current is connected to the motor by an insulated trailing cable, which is shown at the rear of the machine. In addition to the features above mentioned, it will be observed that there is a small steel tank in the outfit that serves as an air receiver. In this work there is no loss of power due to friction in carrying compressed air through a long pipe line, as is the case where the air is transmitted from a stationary compressor, because the portable outfit may be brought to close contact with the job.

The second illustration shows the use of a portable, motor-driven compressor for operating air drills in a coal mine. In outfits for this kind of service the compressor capacity ranges from 100 to 250 cubic feet, requiring from 15 to 50 horsepower in motor capacity. There is a starting panel on the machine, and provision is made for operating two drills at the same time from one compressor. Both alternating and direct-current motors are used for driving portable compressors of this class. Machines of this type are considerably used in coal mines, but only in a few instances in metal mines in which more powerful drills are necessary.

Portable Motor-Driven Air Compressor in a Shipyard.

Use of Portable Motor-Operated Air Compressor in a Coal Mine.

The equipment illustrated is that of the Sullivan Machinery Company, which has also adapted its coal-cutting machinery to motor drive. In this connection, attention may well be called to the use of electric motors in coal mines where gas exists and in which there is danger of explosions due to an electric spark. To obviate this danger numerous tests were made several years ago by the Bureau of Mines at its Pittsburgh Experiment Station, with the view to developing an explosion-proof motor for such work. Among the tests were those made on the Sullivan Machinery Company's ironclad type of motors, consisting of 250-volt and 500-volt direct-current machines. For installations in mines where gas and powdered coal are present in the atmosphere, all outside connections are properly insulated, and the controller contacts and leads are required to be placed inside, instead of outside, the machine. The Sullivan company's "Ironclads" were built for it by the General Electric Company. The motors are compound wound, and are designed to deliver 30 horsepower at 1130 revolutions per minute for one hour without exceeding a temperature rise of 75° centigrade. The motor is contained within an armor-plate casing, which also houses the gears and other mechanical parts, including the rheostat and controller. The protective devices consist of a large number of flat rings, forming a collar that closely fits the opening at each end of the casing that surrounds the armature shaft bearings. The flame, in case of internal ignition, must make its way in a circuitous route through baffle plates before it can escape to the atmosphere in the mine; and before it does reach that atmosphere it is cooled and reduced to a low pressure, leaving insufficient heat to produce an explosion outside of the machine. The casing of the starting rheostat is a part of the machine frame, the controller plate being mounted on one side, and the resistances on the other.

In case the motor is installed as a part of a portable unit, for operating coal cutters or air drills, the electrical connection, by means of the trailing cable, passes through the casing of the rheostat in the form of studs insulated with fiber washers and bushings. An enclosed refillable fuse is mounted in the shaft of the controller, and is so placed that it is accessible from the outside of the machine, but the controller handle must be in the "off" position before the fuse can be removed, and the fuse removal locks the controller handle in the off position.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

CLAREMONT, N. H.—Sullivan Machinery Company has acquired the former steam plant of the Claremont Power Company, and has commenced the installation of new equipment in the structure.

RUTLAND, VT.—Western Vermont Power & Light Company has contracted with Tait Brothers, Clarence Shanks, and the Roberts Slate Company for supplying power to their various plants in the amounts of 15, 25, and 25 horsepower, respectively.

MEDFORD, MASS.—American Radio & Research Corporation has had plans prepared for the construction of a one-story addition to its plant, about 32x100 feet in size.

NEW HAVEN, CONN.—New York, New Haven & Hartford Railroad Company has commenced the construction of a one-story battery charging station, about 20x140 feet, at its Dover street yards in the South Boston district of Boston, Mass. C. W. Murdock, 185 Church street, New Haven, is the building contractor.

BINGHAMTON, N. Y.—Binghamton Light, Heat & Power Company has contracted with the officials of Johnson City for supplying power for the operation of a 50-horsepower motor recently installed in a new addition to the pumping plant.

BROOKLYN, N. Y.—Long Island Railroad Company, Pennsylvania Station, New York, has had plans prepared for the construction of a one-story brick engine house, about 38x102 feet in dimensions, at Eighth avenue and Sixth street, Brooklyn, to cost about $15,000.

BROOKLYN, N. Y.—Bush Terminal Company, 100 Broadway, New York, has had plans prepared for the construction of a one-story addition to its local transformer station. Improvements will also be made in the existing structure.

BUFFALO, N. Y.—New York Telephone Company has filed with the Public Service Commission a new schedule of rates for service applying to Buffalo, Kenmore, Sloan and Snyder.

BUFFALO, N. Y.—Delaware, Lackawanna & Western Railroad Company has commenced the construction of its proposed one-story power house on Currie street, in the East Buffalo district. The J. W. Cowper Company, Inc., Fidelity building, Buffalo, is the contractor.

BUFFALO, N. Y.—Fleischman Malting Company, 2212 Niagara street, has had plans prepared for the construction of a one-story engine plant addition at its works, about 34x57 feet in size, to cost $12,000. The Corrugated Bar Company, Mutual Life building, Buffalo, is architect.

ELMIRA, N. Y.—Elmira Water, Light & Railroad Company has withdrawn its petition to the Public Service Commission for permission to increase its rates for passenger fares on its traction lines to six cents.

CORNING, N. Y.—Lamoka Electric Water Power Company has been chartered to construct a concrete dam across the Lamoka Valley above Bradford, to generate power at a plant to be located near Grove Springs. The power is to be carried to Corning by a transmission line.

GENEVA, N. Y.—Empire Gas & Electric Company has petitioned for authority to issue $171,000 in bonds for extensions and improvements. Address general manager.

NEW YORK, N. Y.—Washburne Wire Company, One Hundred and Eighteenth street and the Harlem river, has commenced the reconstruction of its plant at 528-48 East One Hundred and Eighteenth street, to replace the structure recently destroyed by fire. It is estimated that the new plant will cost in the neighborhood of $350,000.

NEW YORK, N. Y.—The New York Railways Company, 165 Broadway, has leased its former plant at 17 Front street, near Broad street, to the Battery Warehouse Corporation at an aggregate rental of about $200,000.

NIAGARA FALLS, N. Y.—The City Council is planning for the installation of new electric pumping machinery at the municipal water works on Buffalo avenue, to provide for increased capacity.

ROCHESTER, N. Y.—Aurora Battery Corporation has filed notice with the Public Service Commission of the dissolution of the company.

SYRACUSE, N. Y.—Pierce, Butler & Pierce Manufacturing Company, manufacturer of boilers and other heating specialties, is negotiating with the Ames Iron Works, Oswego, for the purchase of the plant of the latter company, consisting of a number of buildings and occupying two blocks included between East Second and Third, Cayuga and Schuyler streets. The company will use the plant for the manufacture of large boilers and engines.

WELLSVILLE, N. Y.—Notice has been filed by the Kerr Turbine Company, South Main street, manufacturer of turbine engines, of an increase in its capital from $500,000 to $2,000,000, to provide for expansion.

DOVER, N. J.—New Jersey Power & Light Company has been awarded a contract for supplying power for the operation of the plant of the Thomas Moore Trench Machine Company, recently established at Rockaway, N. J.

GLOUCESTER CITY, N. J.—Pusey & Jones Company has commenced the construction of a large power plant on the site of the old Gloucester baseball grounds, to provide for the furnishing of power to the plants of the New Jersey and Pennsylvania Shipbuilding companies. The electric energy is now supplied by the Public Service Electric Company.

JERSEY CITY, N. J.—Board of Freeholders has authorized an initial appropriation of $25,000 to provide for preliminary construction work on the proposed central power plant for the county.

JERSEY CITY, N. J.—Central Railroad of New Jersey, Communipaw avenue, has taken out a building permit for the construction of a one-story brick extension to its power house to cost about $50,494.

KEARNY, N. J.—West Hudson Storage Battery Company has filed notice of authorization to operate at 408 Kearny avenue. Nathaniel Gerstel, 326 Devon street, and Richard S. Hill, 468 Chestnut street, both of Kearny, head the company.

NEWARK, N. J.—The Board of Freeholders has approved a total appropriation of $97,350 to be used for light, heat and power purposes for various institutions, etc., throughout the county for the period from May 8, 1918, to December 31, 1918.

NEWARK, N. J.—Heller & Merz Company, Hamburg place, has had revised plans prepared for the construction of a one-story reinforced-concrete power house, about 37x70 feet in size, at its plant. R. G. Cory, 39 Cortland street, New York, is architect.

NEWARK, N. J.—The Board of Freeholders has approved an additional bond issue for $20,000 to provide for the proposed improvements in the heating system at the County Hospital at Overbrook.

POMPTON LAKES, N. J.—The Borough Council has authorized a bond issue for $46,000 to provide for the construction of an addition to the municipal electric plant.

NEWTON, N. J.—Sussex Print Works, Sparta avenue, has plans under consideration for the construction of a one-story brick addition to its power plant, about 50x50 feet in dimensions. The structure is estimated to cost $10,000. Andrew Kidd, Jr., 95 Liberty street, New York, is architect and engineer.

PHILLIPSBURG, N. J.—Lapatoong Water Company has purchased a site for pipe lines and will construct pump and generating station. Address George R. Elder, President, Easton, Pa.

CARLISLE, PA.—Carlisle Light, Heat & Power Company has issued notification of an increase of 15 per cent in its present rates for service.

EASTON, PA.—The Pennsylvania Utilities Company has been awarded a contract by the William Wharton, Jr.,

Company for supplying power in the amount of about 1,500 kilowatts for the operation of a new furnace.

HARRISBURG, PA.—One of the largest river fleets for the reclaiming of coal from the Susquehanna river is now being employed by the Harrisburg Light & Power Company, the coal secured in this manner being used at the power and heat plants of the company.

HARRISBURG, PA.—The City Commission, which recently installed new pumping machinery at the municipal pumping station, has completed other improvements in the electric equipment.

NEW CASTLE, PA.—New Castle Electric Company has filed notice with the Public Service Commission of the issuance of bonds for $11,000 to provide for improvements, etc.

NEW CASTLE, PA.—Shenango Valley Electric Company has filed notice with the Public Service Commission of a bond issue for $39,000 to provide for improvements, extensions, etc.

PHILADELPHIA, PA.—Phoenix Dye Works, White street, has awarded a contract for the construction of an addition to its boiler plant. John T. C. Miller, 2315 Clearfield street, is the contractor.

PHILADELPHIA, PA.—Philadelphia Electric Company, 1000 Chestnut street, has had plans prepared for alterations and improvements in its building at Arch and Mascher streets. The company is also planning for the construction of a one-story brick, steel and stone addition to the structure, about 20 x45 feet in size.

PHILADELPHIA, PA.—The United States Government has had plans prepared for the construction of a one-story brick power house, about 57x154 feet, and one-story brick transformer house, about 18x30 feet, at the League Island Navy Yards.

PHILADELPHIA, PA.—J. F. Burns, 613-15 Cherry street, manufacturer of electrical specialties, has taken bids for the construction of a new five-story brick addition to its plant, about 30x52 feet. John V. Speth, 1615 Sansom street, Philadelphia, is architect.

PITTSBURGH, PA.—The Aluminum Company of America is planning for the construction of a large new nitrate plant near Maryville, Tenn., on a site comprising about seven acres. Power for the operation of the works will be supplied by the new hydroelectric plant of the company at Algoa. At this latter point the company now has in course of construction a new dam on the Little Tennessee river, which will cost about $100,000. The entire project is said to be estimated to cost $2,000,000.

SAYRE, PA.—Sayre Electric Company has been awarded a contract by the Borough Council for furnishing service for the operation of the electric street-lighting system for a period of five years.

NORFOLK, VA.—Virginia Railway & Power Company has awarded a contract for improvements to its local electric substation to cost about $11,700. Nichols & Linderman, Seaboard Bank building, Norfolk, are the contractors.

PARKERSBURG, W. V.—Parkersburg Iron & Steel Company has had plans prepared for the construction of an addition to its power plant to cost about $12,000. The structure will be 30x45 ft. in size.

RICHMOND, VA.—Williams Power Company, which recently increased its capital from $50,000 to $150,000, is considering plans for extensions and improvements in its electric-lighting system.

ACWORTH, GA.—Acworth Hosiery Mills are planning for the installation of a quantity of new knitting machines in its plant, to be electrically operated. The equipment is estimated to cost $16,000.

KEY WEST, FLA.—Bell Telephone Company is planning for the construction of a two-story telephone exchange building to cost, with equipment, about $200,000.

NORTH CENTRAL STATES.

CLEVELAND, OHIO.—Wellman Seaver Morgan Company will erect a $30,000 power house. The building will be 46x97 feet in dimensions, steam heat, electric lighting, electric, steam and power equipment.

INDIANAPOLIS, IND.—Merchants Heat & Light Company has petitioned for authority to issue $140,000 in bonds for the purchase of the Danville Heat, Light & Power Company. Address H. H. Harrison, president, 2 West Washington street.

HOMER, MICH.—Homer Electric Power Company will enlarge its plant.

PONTIAC, MICH.—The city of Pontiac has appealed to the State Highway Commission to compel the Consumers Power Company to make extensions which will furnish electric light and power to districts in which the firm has refused to build lines. Address city clerk.

MENASHA, WIS.—The council will purchase additional engines for the municipal light and water system.

WINNECONNE, WIS.—Winnebago Electric Company will install an electric plant to supply electricity for heaters and motors. Address Richard W. Button.

NEOLA, IOWA.—About $16,000 will be expended in improving the light and power system. Address city clerk.

SHARON CENTER, IOWA—J. R. Terry, of Cedar Rapids, has petitioned for a franchise to furnish Sharon Center with electric light.

ARCHIE, MO.—The city will probably have electric current furnished by the L. K. Green & Sons of the Green Light & Power Company of Pleasant Hill, Mo. Five thousand dollars of the required $7,000 worth of stock in the company has been subscribed by the Archie citizens.

MAYSVILLE, MO.—Some electric light improvements are to be made here.

MARSHALL, MO.—V. V. Huff of this city, attorney for the city in its suit to compel State Auditor George E. K. Hackmann to register $75,000 in bonds, voted by the city June 22, 1916, for the purpose of building and equipping a municipally owned electric light plant, received a telegram last week from Jefferson City, stating that the Supreme Court decided the case in favor of the city. As soon as the briefs could be prepared and submitted to the court its decision was handed down, which practically closes the case and makes it possible for the city to proceed with the construction and equipment of the plant for which it has fought so long.

JENNINGS, KANS.—A torch exploded at the electric light plant in Jennings and set fire to a 46,000 gallon oil tank.

WICHITA, KANS.—Wichita may have cheaper electricity. A hearing was had May 7 by the Kansas Public Utilities Commission concerning some of the complaints made by residents against the company. It was admitted by the company's attorney that the complaints were in a general way true.

RIVERTON, NEB.—Electric improvements are to be made here soon.

MILLER, S. DAK.—Plans are being prepared for the construction of a municipal electric light and water system. Address William Saltmarsh, city manager

CROSBY, N. DAK.—The plant of the Crosby Electric Light & Power Company was recently destroyed by fire with a loss estimated at $25,000.

DATES AHEAD.

Electrical Contractors' Association of Georgia. Annual meeting, Tybee Island, Ga., June, 1918. Secretary, Dan Carey, 614 Chamber of Commerce building, Atlanta, Ga.

American Society of Mechanical Engineers. Spring meeting, Worcester, Mass., June 4-7. Secretary, Calvin W. Rice, 29 West 39th street, New York City.

National Electric Light Association. Annual convention, Hotel Traymore, Atlantic City, N. J., June 13 and 14. Secretary, T. C. Martin, 33 West 39th street, New York City.

Texas State Association of Electrical Contractors. Annual meeting. Galveston, Tex., June 15, 1918. Secretary, H. S. Ashley, Fort Worth, Tex.

Southeastern Section, National Electric Light Association. Annual meeting, Atlanta, Ga., June 19-20, 1918. Secretary-Treasurer, T. W. Peters, Columbus, Ga.

American Institute of Chemical Engineers. Summer meeting, Berlin, N. H., June 19-22. Headquarters, Mt. Madison House, Gorham, N. H. Secretary, John C. Olsen, Brooklyn, N. Y.

United States Independent Telephone Association. Annual convention, Hotel La Salle, Chicago, Ill., June 25-28. Secretary, W. S. Vivian, 19 South La Salle street, Chicago, Ill.

American Institute of Electrical Engineers. Annual convention, Atlantic City, N. J., June 26-28. Secretary, F. L. Hutchinson, 33 West 39th street, New York City.

Ohio Electric Light Association. Annual meeting, Cedar Point, Ohio, July 10-12. Secretary, D. L. Gaskill, Greenville, Ohio.

National Association of Electrical Contractors and Dealers. Annual convention, Cleveland, Ohio, July 17-20. Secretary, Harry C. Brown, 101 West 40th street, New York City.

Northwest Electric Light and Power Association; affiliated with N. E. L. A. Annual meeting, September 11, 1918. Secretary, George L. Myers, Pacific Power & Light Company, Portland, Ore.

International Association Municipal Electricians. Annual convention, Atlanta, Ga., September 24-27. Secretary, Clarence R. George, Houston, Tex.

SOUTH CENTRAL STATES.

CLARKSVILLE, TENN.—Christian-Todd Telephone Company is considering plans for improvements in its telephone system.

RUTHERFORD, TENN.—The city authorized a bond issue for $10,000 to provide for improvements in the electric-lighting plant.

HEADLAND, ALA.—A bond issue for $10,000 has been approved to provide for improvements in the electric-lighting plant and water works.

LITTLE ROCK, ARK.—Mutual Motors Company is considering plans for the construction of a shop building to be used for the manufacture of electric motors.

JENNINGS, OKLA.—The city is considering a bond issue for $25,000 to provide for the installation of a new electric-lighting system.

DALLAS, TEX.—It is stated by J. N. Crotty, vice president and general manager of the East Texas Traction Company, that the construction of its interurban electric railway between Dallas and Greenville has been suspended until after the war. There has been expended up to this time by the company about $500,000 in the construction of grade, bridges and culverts. The Government requirements for steel and copper are so urgent that the company decided to forego its plan temporarily for the construction of the road.

WESTERN STATES.

GREAT FALLS, MONT.—Montana Electric Company has been granted a permit to erect a $10,000 brick warehouse.

KINGMAN, ARIZ.—Schuylkill Mining Company is planning for the construction of a power plant to provide for the operation of a new 200-ton milling plant now in course of construction at its works.

PHOENIX, ARIZ.—The board of managers of the State Hospital for the Insane has had plans prepared for the construction of a power house at the institution.

YUMA, ARIZ.—Imperial Oil Mills Company is planning for the erection of new electric light and power lines in public highways of Yuma Valley, Yuma county.

MINA, NEV.—Considerable new electric machinery will be installed in the new 100-ton concentrating plant to be erected at the Gunmetal tungsten mine about 23 miles from Mina.

PALISADE, NEV.—In connection with the construction of a large new concentrating plant to be erected by the Union Mines Company at its properties, considerable new electric machinery will be installed.

EPHRATA, WASH.—C T. Sanders, county auditor, announces that the Ruff Lighting Company has asked for a franchise to construct, maintain and operate a transmission line for light and power over certain county roads.

LOON LAKE, WASH.—Loon Lake Copper Company has had plans prepared for the construction of a 100-ton concentration mill at its plant to cost $40,000, and is considering plans for the installation of new electric machinery.

PROPOSALS

ELECTRIC STERILIZERS. — Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for electric sterilizers. Refer to Schedule 1802.

SWITCH CONTROL, PASSENGER ELEVATOR, ETC.—Bids will be received at Room 406, City Hall, Chicago, for furnishing two automatic push button controls, one switch control and one passenger elevator in Ward No. 2, Contagious Disease Hospital, according to plans and specifications on file. Frank I. Bennett, commissioner of Public Works.

ELECTRIC DISTRIBUTING SYSTEM.—The Bureau of Yards and Docks, Washington, D. C., will receive bids until May 27 for the installation of an electric distributing system at the Great Lakes Naval Station.

ELECTRIC DUCT SYSTEM.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 27, for the construction of an eight-way tile duct system with manholes complete for breakdown service, between Frequency Changer building, navy yard, and Capital Power Plant, Garfield Park, Washington, D. C. Refer to Specifications No. 2959.

INCORPORATIONS

LITTLE ROCK, ARK.—Arkansas Battery Company. Capital, $10,000. To manufacture electric batteries. Incorporators: W. P. Galloway, J. W. Hamm, and C. P. Pierce, Little Rock.

DOVER, DEL.—Electrical Riveting Corporation. Capital, $1,250,000. To manufacture electrical welding, heating and riveting apparatus. Incorporators: M. M. Clancy, C. L. Rimlinger, and F. A. Armstrong, Wilmington.

JACKSONVILLE, FLA. — Wilson Electric Company. Capital, $5000. To manufacture electrical supplies. Incorporators: Jesse L. Wilson, M. W. Wilson, and W. J. Wilson.

INDIANAPOLIS, IND. — Higgins-Lalley Light Company has incorporated with a capital of $7500 to buy and sell light and power plants. Address George W. Higgins, 2140 College avenue.

MARSHALLTOWN, IOWA.—Marshall Electric Company has incorporated with a capital of $50,000. E. N. Peak is president of the new company.

NEW YORK, N. Y.—International Insulating Corporation. Capital, $60,000. To manufacture insulating materials. Incorporators: O. and A. Heineman, and J. Schechter, 10 Wall street, New York.

BROOKLYN, N. Y.—Bolton-Wechtel Company. Capital, $20,000. To manufacture electric batteries, etc. Incorporators: H. J. Wechtel, and W. C Bolton, 261 Stuyvesant avenue, Brooklyn.

NEW YORK, N. Y.—Abeles-Lalley Light Corporation. Capital, $30,000. To operate electric lighting plants. Incorporators: S. Andrews, L. Fischel and H. H. Seabrook, 510 Audubon Avenue, New York.

POTEAU, OKLA.—Citizens' Consolidated Power & Electric Company was recently incorporated with a capital of $25,000. Address E. S. Hutton.

NEWPORT, WASH.—Calispell Valley Lighting & Power Company has been incorporated with a capital of $10,000. A. J. Schinsby and G. A. Rodgers are the incorporators.

NEW PUBLICATIONS

THE VEGETATION OF SHACKLEFORD BANK.—The North Carolina Geological and Economic Survey announce the recent publication of economic paper No. 46, The Vegetation of Shackleford Bank, and economic paper No. 47, Proceedings of the Ninth Annual Drainage Convention of the North Carolina Drainage Association. Copies of these papers may be had for 10c to cover mailing and packing charges.

THE STORAGE OF BITUMINOUS COAL.—The Engineering Experiment Station of the University of Illinois has just completed a study of the problems involved in the storage of bituminous coal and has published the results in a 200 page illustrated book designated as Circular No. 6 "Storage of Bituminous Coal." The study was made under the direction of H. H. Stoek, professor of mining engineering. The reasons and advantages of storing coal are given, the kinds and sizes of coal which may be safely stored are described, and the many factors entering into successful storage are discussed. Copies of this book may be had by addressing the Engineering Experiment Station, Urbana, Ill. The price is 40 cents a copy.

A STUDY OF THE HEAT TRANSMISSION OF BUILDING MATERIALS.—This bulletin covers an investigation to determine the coefficients of heat transmission of standard building materials for exterior walls that has been completed by the Engineering Experiment Station of the University of Illinois, under the direction of A. C. Willard, professor of heating and ventilation, and L. C. Lichty, research fellow. The tests were conducted according to the so-called "hot-air box" method, the boxes having been built of the material to be tested and of such size as to insure conditions similar to those found in actual practice. The heating was done electrically so that the input of heat could be controlled and accurately measured. The materials tests included various sizes of tile plastered, magnesia board, cork board, wood, concrete, brick, glass with and without an air space, sheet asbestos and asbestos board. The degree to which the transmission coefficients of the various materials are affected by variations in air velocity, by humidity, and by the use of air spaces in wall is discussed, and the results of the tests are given in detail in Bulletin 102 of the Engineering Experiment Station. The publication is illustrated with diagrams and photographs of the apparatus.

Trade Activities

Driver-Harris Company Personnel—Crouse-Hinds Company Promotes War Garden Work—Valuable Catalogs

The Clarage Fan Company of Kalamazoo, Mich., has moved its Chicago office to 1666 Conway building, where G. J. Thomas is in charge. This company lately sold two exhaust fans to the Illinois Malleable Iron Company, Chicago, for its foundry. Each fan is direct-connected by shaft and coupling to a 30-horsepower motor.

International Insulating Corporation, Springfield, Mass., announces the change in ownership of the Dickinson Manufacturing Company, Springfield, Mass, heretofore engaged in the manufacture of molded insulation. This new company, which has taken over the entire business of the Dickinson interests, is materially enlarging and improving its facilities and will endeavor to combine efficiency with quality in supplying the needs of its patrons. Thomas E. Griffin is manager of the company.

Cutler - Hammer Manufacturing Company, Milwaukee, Wis., has recently issued a folder, which describes and illustrates C-H electrical industrial stoves for laboratories, printing and publishing plants, celluloid, hat and shoe factories, test rooms and industrial service in general. The stoves are made in two types, one has a rectangular heating surface, and the other a disk or circular surface. The heating units are electrically welded to the working surface. The folder describes other details of construction and gives sizes, wattage and other data.

Hamilton - Beach Manufacturing Company, Racine, Wis., is conducting an extensive advertising campaign to promote the sale of the Hamilton-Beach line of home motors, vibrators, hair dryers and other products, and for this purpose has appropriated $150,000, which means an expenditure of $500 daily. The benefits to be derived from this campaign are not limited to the company alone, as an exceptional opportunity is afforded the dealer of Hamilton-Beach products to add to his sales and profits. To aid the dealer in lining up his local advertising with the national campaign of the Hamilton-Beach Company, a book of selling helps has been prepared. This is well illustrated and contains a great variety of valuable advertising matter for the dealer; an excellent assortment of lithographed cutouts and window cards for display are shown as well as reproductions of strong and convincing advertisements now appearing in magazines, among which are the Ladies' Home Journal, Literary Digest and Pictorial Review, and electrotypes of these will be furnished to the dealer. Booklets, folders, circulars, street car cards, lantern slides are also offered gratis to the distributors of this line of products.

Delta-Star Electric Company, 2433-2443 Fulton street, Chicago, is distributing bulletin No. 33, devoted to high-tension-switching and protective equipment. This is a 64-page bulletin with 309 illustrations, and also contains considerable technical information. Copies will be sent upon request.

Crouse-Hinds Company, Syracuse, N. Y., manufacturer of electrical specialties, has arranged for a total of about seven acres of land near its works to be devoted to "war gardening" by its employes. About 100 of these employes have already agreed to take these plots for the coming summer. The company, which is one of the city's first large manufacturing concerns to take up this movement, is arranging to plow the ground at its own expense for its employes.

Electrical Engineering Company, 440 South Dearborn street, Chicago, which was incorporated last December under the laws of Illinois, is engaged in the design, manufacture and sale of electrical devices, specializing particularly in moving picture control apparatus, high and low tension transformers and coil winding. The president of the company is R. A. Connor, formerly connected with the Thordarson Electric Company, as general manager and designing engineer. J. H. Thompson, formerly sales manager of the Thordarson company, is vice-president, and G. C. Jensen, who in the past has served some of the largest central station companies in various capacities, is secretary and treasurer.

The Hy-Watt Battery Company, Cleveland, Ohio, is distributing circular matter, descriptive of its line of batteries, which embodies several unique features. Unlike the regular round battery, it is made right side out with the zinc inside and is claimed to deliver current until the zinc is entirely consumed. The single battery, according to the company, has 75 per cent more electrical energy than the round cell, and is guaranteed to be water and weather proof. While it is slightly higher in price than the older type battery, the difference in cost is more than overbalanced by the guarantee of service which it carries. Since traffic laws in all states have been more strongly enforced and the use of tail lights on all moving vehicles, whether horse drawn or motor driven, required, the Hy-Watt Battery Company has during the past winter specialized in the manufacture of tail lights. In another circular is shown the particular type of tail lighting outfit in use by the Standard Oil Company, 900 of this type having been purchased for the state of Ohio alone. The lamp can be furnished in different types and styles, showing a white or red light as desired.

Driver-Harris Company, Harrison, N. J., announces the election of the following officers: Frank L. Driver, president; Arlington Bensel, first vice-president; Leon O. Hart, second vice-president; Percival E. Reeves, treasurer; Stanley M. Tracy, assistant treasurer, and M. C. Harris, secretary. Wilbur B. Driver, formerly vice-president, has retired from active participation in the business.

Randle Machinery Company, Cincinnati, Ohio, has issued a booklet covering a partial list of the machinery which it has to offer. Included in this list are both alternating and direct-current motors, generators, transformers, engines, rebuilt boilers and other power plant equipment. Among other products manufactured by the company is an extensive line of switchboards, designed to meet any requirement, knife switches, back and front connected, also oil break switches in various voltages and capacities, meters and wire. All of these items as well as many others not mentioned are of excellent quality and are backed by the long experience, reputation and guarantee of the Randle Machinery Company.

Westinghouse Employes Subscribe $2,601,000. Final reports of the Liberty Loan campaign among employes of the Westinghouse Electric & Manufacturing Company and its subsidiaries show that the total subscription was $2,601,000. Of this, $2,217,000 was taken by employes of the parent company. Three subsidiaries showed 100 per cent of employes subscribing —the R. D. Nuttall Company, the Krantz Manufacturing Company and the Pittsburgh Meter Company. In addition to this, the Krantz employes subscribed the largest per cent of total pay roll—10.4 per cent, and the largest average per subscriber, $87.27. Electric Company employes to the number of 32,048 subscribed $69.18 per capita, 5.2 per cent of the pay roll. All figures show a gratifying increase over those of the Second Loan, showing that Westinghouse men and women are solidly backing their 4000 fellow workers now with the colors.

As might be expected in a company employing over 30,000 people, comparable to a good sized city, the Third Liberty Loan campaign possessed some unusual features. In order to cover the entire works thoroughly from office boy to executive, team captains were appointed who in turn selected their lieutenants and teams. The members of these teams sold every employe a bond, or got a very satisfactory reason for the refusal.

It is interesting to note that the telephone and sales record departments, composed practically altogether of girls, were among the 100 per cent departments, that is every employe a bond owner.

Latest Approved Fittings

The electrical fittings listed and described in this department have been approved by the Underwriters' Laboratories, Incorporated, after examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

Conduit Boxes. — V. V. Fittings Company, Philadelphia, Pa.

"V. V." cast-iron conduit boxes. "5 Series" including 5-A, 5-B, 5-C, 5-F, 5-K, 5-L, 5-T, 5-U, 5-X, 5-Y, when provided with cast sheet-metal or porcelain covers, Midget lamp guards, snap-switch hoods, rosette or receptacles, GEA, GEC, PA, PC.

Note: These boxes are threaded so as to be firmly secured by screwing to conduit. When they are entirely exposed, no other support for these boxes is required. If not entirely exposed, they must be securely fastened in place independently of support afforded by conduit. In all cases covers and attachments must be exposed and easily removable.

Listed January 25, 1918.

Conduit Outlet Bushings and Fittings.—V. V. Fittings Company, Philadelphia, Pa.

Cast-iron nipple with porcelain bushing, type 6.

Cast-iron pipe clamps or straps, Catalog Nos. 4 to 10 inclusive.

Listed January 25, 1918.

Conduit Outlet Bushings, Service-Entrance.—V. V. Fittings Company, Philadelphia, Pa.

Cast-iron outlet bushings, types 2, 9.

Listed January 29, 1918.

Cutout Bases, Cartridge-Fuse.—The Bryant Electric Company, Bridgeport, Conn.

"Bryant or Perkins," 0-600 amperes, 250 volts, catalog No. 576.

Listed March 22, 1918.

Fixture Fittings. — George Cutter Company, South Bend, Ind.

Holder-sockets and receptacles for "Sol-Lux" and other standard-heel reflector fixtures.

"Cutter" medium-base, porcelain-shell, keyless. Catalog Nos. 30650, 30651 and 30652.

"Cutter" mogul-base, porcelain-shell, keyless. Catalog Nos. 30654, 30655 and 30656.

Listed April 4, 1918.

Fixture Fittings, Vaporproof.—V. V. Fittings Company, Philadelphia, Pa.

Type "5 Series," AM, BM, CM, FM, KM, LM, TM, XM, AML, BML, CML, FML, KML, LML, TML, XML, AL, BL, CL, FL, KL, LL, TL, XL, TMA, TMB.

Listed January 29, 1918.

Fuses, Special Type.—General Electric Company, Schenectady, N. Y.

Time-element plugs designed to afford protection to motors against overloads maintained for longer than predetermined periods. Inclosed in metal case and mounted in special double-pole plug-fuse cutout base provided with screw shells with left-hand threads.

Types CR-1920, 5 horsepower, 440 and 220 volts; 3 horsepower, 110 volts.

Note: The National Electrical Code fuses required for motor circuits in Rule 8c must be installed in circuit in addition to time-element plugs.

Listed March 22, 1918.

Heaters, Air.—Edison Electric Appliance Company, Inc., 5660 West Taylor street, Chicago, Ill.

"G. E." luminous, 750-1500 watts, 95-250 volts, type A-23.

Non-luminous, 1200-5000 watts, 95-250 volts, types A47, A-48, A-49, A-52, A-53.

Listed April 16, 1918.

Heating Appliances, Cooking and Liquid. — Edison Electric Appliance Company, Inc., 5660 West Taylor street, Chicago, Ill.

Range oven heater, 1500 watts, catalog No. 175974.

Range hot plates, 1000-1500 watts, catalog Nos. 89990, 89991 and 89992.

Toasters, 550-3500 watts, type D-65.

Water heaters, circulation, 600-5000 watts, type L-63.

Individual contact plugs, for use with "G. E." heaters, catalog Nos. 142649 and 173064.

Listed April 14, 1918.

Heating Appliances, Industrial and Laboratory.—General Electric Company, Schenectady, N. Y.

Glue pots, 20-1100 watts, types 1-3, 1-5.

Listed April 19, 1918.

Lamp Adjuster.—W. N. Matthews & Brother, Inc., 3722 Forest Park boulevard, St. Louis, Mo.

"Matthews Holdfast Adjustable." Sheet-steel adjustable clamp which may be used with two tubular arms to form adjustable fixture.

For use with portable flexible cord or stranded conductors when tubular arms are suitably supported and bushed for wires.

Listed April 8, 1918.

Spliceless Connection Block.—The Bryant Electric Company, Bridgeport, Conn.

"Bryant." Consisting of four terminal plates, each with two binding screws, mounted on base of insulating material. Designed for mounting in conduit box to facilitate making of connections. Catalog No. 577.

Listed April 9, 1918.

Static Neutralizer. — The Portland Company, Portland, Me., manufacturer; United Printing Machinery Company, Jamaica Plain Station, Boston, Mass., submittor.

"Chapman" static neutralizer, consisting of either rotary converter, belt-driven alternator, or static transformer with special cables and fittings including inductor bar mounted on machine. For use in neutralizing static charges in woolen, silk, cotton and paper mills, printing offices, etc. 660 watts, 110-220 volts.

Listed April 1, 1918.

Switches, Inclosed.—The Trumbull Electric Manufacturing Company, Plainville, Conn.

"Circle T," two, three and four-pole knife switches and cutout bases for standard plug or cartridge inclosed fuses. Inclosed in metal cases and designed for manual operation without opening cases. 30, 60, 100 and 200 amperes, 250 and 500 volts, alternating current, catalog Nos. 13610-19 inclusive.

Three-pole, motor-starting knife switch with clips for standard cartridge inclosed fuses which are short-circuited when switch is in starting position. Inclosed in metal case and designed for manual operation without opening case. 30 amperes, 250 volts, catalog No. 13550.

Listed February 26, 1918.

Switch Boxes.—V. V. Fittings Company, Philadelphia, Pa.

"V. V." cast-iron single and gang-type boxes for mounting switches and attachment-plug receptacles, with or without cast-iron covers for push, flush, snap switches.

Flexible and rigid conduit pattern, type B.

Listed April 17, 1918.

Wire, Flexible Cord.—Standard Underground Cable Company of Canada, Ltd., Hamilton, Ontario.

Marking: Two brown threads cabled with copper strand.

Listed March 14, 1918.

Wire, Rubber-Covered. — National Metal Molding Company, Fulton Building, Pittsburgh, Pa.

Marking: One black and one yellow thread in braid.

Listed March 13, 1918.

Wire, Miscellaneous.—D. & W. Fuse Company, Providence, R. I.

Pendent cord composed of two conductors, each of which is made up of a stranded copper conductor of No. 18, 16 or 14 B. & S. gauge, insulated with a cotton wrap, a wall of rubber and a covering of felted asbestos. Conductors are run in parallel with a filler of cotton twine and cord is provided with outer braid of asbestos given a hard white white finish. Suitable for general use as pendants where not exposed to moisture.

Marking: Two black threads running parallel with conductors under asbestos braid.

Listed January 18, 1918.

Recent Patents

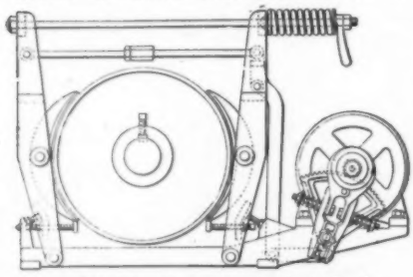
Selected and Summarized by Albert Scheible, Patent Attorney, 79 West Monroe Street, Chicago, Illinois

A series of brief comments on some of the recently issued electrical patents which appear to be of particular interest to our readers, the number after each heading being that of the United States patent to which the summary relates. Any correspondence regarding such patent matters should be sent direct to Mr. Scheible at the above address.

Reflecting Lamp (1,261,789).—This is one of seven patents to Harry A. Douglas, of Bronson, Mich., issued as numbers 1,261,783 to 1,261,789 inclusive, and all relating to methods of mounting lamp sockets in reflectors so that the lamp may be changed in focal adjustment by moving it along the axis of the reflector.

Electric Fitting (1,261,874).—A conduit fitting consisting essentially of a pipe coupling with a lateral enlargement adapted to house a switch. Patent assigned by Samuel B. Van Ranst, of Syracuse, N. Y., to the Crouse-Hinds Company.

Motor-Controlled Brake (1,261,771). Where a motor is used for releasing a brake which is mechanically set, the brake-setting spring does not always stall the motor properly when the brake is reset, and the inertia of the motor armature therefore causes a



No. 1,261,771.—Motor-Controlled Brake.

variable braking effect. To avoid this, and to assure a gradual stopping of the motor within a given time, John S. Coldwell, of Milwaukee, gears the motor shaft to a sector connected by links to the brake, and permits sufficient play so that the motor may freely revolve in the reverse direction. The patent was assigned to the Cutler-Hammer Manufacturing Company.

Arc-Light Carbon (1,261,891).—An inner pencil of carbon is mounted within a carbon tube closed at its rear end to prevent the passage of air, and the carbon tube is coated on its outer surface with a film of metal for regulating the speed of burning of the carbon. Patented by Hertha Ayrton, of Hyde Park, London, England.

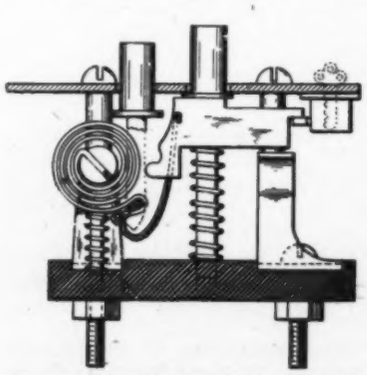
Automatic Train Control (1,261,981).—Both permanent magnets and electromagnets are located along a track, the latter being controlled according to track conditions, and a polarized relay on the train is adapted to be magnetically affected by the magnets. This relay, together with the speed of the train, jointly exert a controlling influence on the movement of the train. Patented by Thomas W. Varley and William C. Nein, both of New York City.

Voltaic Cells (1,262,019 and 1,262,020).—One of these two patents to Miller E. Conrad, of Atlantic, Iowa, relates to the use of an oxyarsenide of iron as the negative electrode in a voltaic cell, while the other proposes an oxyphosphide of iron for the same purpose.

Wire Connector (1,256,813).—To insure good electrical contacts without using solder, Harry T. Martin, of Milwaukee, Wis., twists the tip of each wire into a socket in a connector element made of a brass much harder than the wire, so that the thread in the brass will cut its own thread on the wire. This hard brass element is mounted in an insulating block against which the ends of the insulation on the wires abut.

Continuous-Current Generator (1,256,912).—Where separately excited generators are exposed to short-circuits, the short-circuit current sometimes reaches injurious values in spite of a counteracting compound winding. To avoid this, Frans G. Liljenroth, of Westeras, Sweden, also provides a non-saturated magnetic shunt for the main magnetic field, and places on this shunt a winding in series with the compound winding and in inductive relation to a transformer winding which is in series with the load current.

Thermal Electric Cutout (1,261,256).—Under this title, Roy H. Maple, of Indianapolis, has patented a thermo-electric circuit-breaker for use on low-

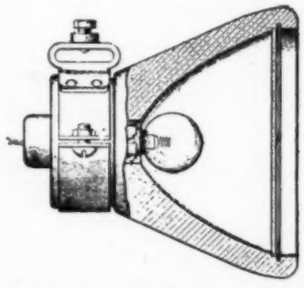


No. 1,261,256.—Thermal Cutout and Switch.

voltage circuits, such as battery lighting circuits, which can also be used as a simple switch when the thermostat is carrying the regular load. When an overload is prolonged, a coiled thermal strip partly unwinds and permits the switch blade to move away from the contacts.

Electrolytic Apparatus (1,262,248.)—For electrolytically producing copper or other metals, Marcel Perrem-Lloyd, of Boulogne-sur-Seine, France, uses two relatively large electrodes, one of which is rotated. These electrodes are so shaped that the strength of current passing between them at different points is proportional to the relative speed of those parts.

Non-Glaring Reflector (1,262,517).—To reduce the glare effects from a reflector of the kind used for vehicle



No. 1,261,517.—Non-Glaring Headlight.

lamps, Charles J. Klein, of Milwaukee, makes the reflector out of molded vitreous material with a dark glazed interior. His patent (issued on an application filed in March, 1913) also broadly claims a lamp body portion formed of a vitreous material having a glazed inner surface shaped to form a parabolic reflector.

Selective Circuit Controller (1,262,150).—Instead of operating a selector by successively energizing an electromagnet, Paul R. Werner, of Philadelphia, uses a single armature between two electromagnets which exert substantially equal attractive force on it. Then he selectively de-energizes one or the other of these magnets, so as to cause the opposed magnet to actuate the armature.

Preventing Oscillating Discharges (1,261,178).—To prevent an oscillatory discharge between spaced electrodes when the current between them is started and stopped, William W. Strong, of Mechanicsburg, Pa., utilizes the fact that ions in a gas between metallic electrodes serve to carry current between the electrodes. With this in mind, he maintains the effective surface of one electrode in a state of incandescence by surface combustion, and leads a combustible gas to this electrode.

Men in Service

M. C. Turpin Joins Technical Publicity Bureau, Ordnance Department—L. R. Dutton Engages in War Welfare Work

FERDINAND ARENDS, for years connected with the stores department of the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has resigned to enlist in the navy.

D. F. RADSLIFF, chief engineer of the Northern States Power Company at Grand Forks, N. Dak., has joined the Thirty-fourth Engineering Regiment at Wrightstown, N. J.

CARL H. REEVES, an engineer of Seattle, Wash., has been commissioned a major in the U. S. Engineer Corps and placed in charge of the construction of a large cantonment being built just across the river from Washington.

FRANK W. HARRIS, formerly locating and construction engineer of Seattle, Wash., is now in government service as a captain of Company B, 42nd Engineers. He is at present located at Camp Humphreys, where the regiment to which he is attached is being recruited for foreign service.

L. R. DUTTON, manager of the Jenkintown division of the Philadelphia Suburban Gas & Electric Company, has been granted a leave of absence by the company to engage in war welfare work in connection with military training camps. Mr. Dutton will take up his duties as a secretary of the Y. M. C. A. at a base hospital located at Camp Dix, Wrightstown, N. J.

THE AMERICAN SOCIETY OF CIVIL ENGINEERS, with headquarters at 33 West Thirty-ninth street, New York City, in its April report of proceedings, publishes in alphabetical order its roll of honor, which now lists 1,142 members, who are serving and have served in the Army or Navy of the United States, or any of its Allies. The list shows the name, position held with the company, military organization and present address of those enlisted where available. Among these members are many who have earned commissions of high rank and the names of several are listed who have given their life for their country and for the cause. The Society can well be proud of its representation serving our country.

EDMUND G. SIMONS, assistant transit commissioner of Pittsburgh, Pa., has been called into active service as first lieutenant in the Engineer Reserve Corps, and with his past experience he is particularly well qualified for this type of service. Mr. Simons was graduated from Union College, Schenectady, N. Y., in 1905, and since then has spent the greater part of his time on construction work, including general contracting, ship canal construction, construction of subaqueous tunnels, steam and hydro-electric power station building and railroad construction in China. He has for the past two years devoted the greater portion of his time on studies for the relief of transit problems in Chicago and Pittsburgh.

ROLL OF HONOR.

The electrical industry, perhaps to a greater extent than any other industry, has answered the call of the Nation for Men. As this is a war of engineers, naturally the technically trained men in the electrical industry have been in great demand and they have responded with splendid patriotism. Many of the large utility and industrial corporations have assigned men for Government service aside from those who have voluntarily entered or been called for service.

THE ELECTRICAL REVIEW *will welcome news concerning men who have entered the service or who are engaged in any patriotic duties.*

M. C. TURPIN, assistant to the manager, Westinghouse Department of Publicity, East Pittsburgh, Pa., has resigned to enter government service in the capacity of assistant to the manager, Technical Publicity Bureau, Ordnance Department, Washington, D. C. This is

M. C. Turpin.

the department organized by Major A. A. Gray, formerly vice-president of the Electrical Review Publishing Company, to co-ordinate the work of the Ordnance Department with the industries through the medium of the trade and technical press. Mr. Turpin has been connected with the publicity department of the Westinghouse companies since 1909 and has been assistant to the manager since 1915. He is a graduate of the Alabama Polytechnic and Cornell University. He has represented the Westinghouse interests at many electrical conventions and has been responsible for the attractive exhibits held.

JOHN BAUER, master mechanic of the Eastern Wisconsin Electric Company, Oshkosh, Wis., has resigned his position to enlist as a mechanic in the Aviation Corps.

COMMONWEALTH EDISON COMPANY has added the following names to its roll of honor: H. M. Buehler, O. E. Nottelmann, K. Sarpalius, R. Schober, J. W. Martin and F. Koukoski.

S. B. MATSON, assistant sales manager for the Marron Electric Company, Rock Island, Ill., has resigned his position and has gone to New York to prepare for Y. M. C. A. service overseas.

WILLIAM N. BISSELL has resigned as assistant treasurer of the Houghton (Mich.) County Traction Company and Houghton County Electric Light Company to enlist with the Headquarters Department, Thirteenth Engineers, Railway, U. S. Army, American Expeditionary Force.

JAMES J. KIRK, who for five years has been head of the illuminating engineering department of the Commonwealth Edison Company, Chicago, has joined the National Army and left for Jefferson Barracks, Mo., last Monday. Mr. Kirk is well known in lighting circles, having been for the last two years chairman of the Industrial Lighting Committee of the Commercial Section, National Electric Light Association, and for the same period secretary of the Chicago Section, Illuminating Engineering Society.

ARMOUR INSTITUTE OF TECHNOLOGY, Chicago, is one of the best represented of educational institutions in government service, graduates, students and faculty having alike responded most generously to the call of the country. About one-fifth of the entire number of graduates and students are now in active service and this number is being increased almost daily. Among electrical engineering students who have enlisted in the army or navy are the following: S. N. Abrams, J. F. Adamson, A. J. Allyn, R. B. Anthony, W. J. Baer, C. C. Bailey, H. W. Bland, T. C. Bolton, W. L. Borroughs, C. L. Burnham, G. R. Burris, F. E. Busbey, C. F. Butler, P. Eickenberg, P. W. Evans, C. D. Fisher, J. E. Fitch, W. F. Fryburg, J. J. Gilbert, D. M. Coe, F. Goodheim, L. I. Gardinier, J. D. Harrey, R. Heim, C. F. Holmes, H. Huber, V. Hupp, M. A. Johnson, E. C. Lang, H. O. Lawson, E. E. Luder, J. K. McCalmont, W. P. McGuire, E. D. MacEwing, W. C. Mann, V. Michael, R. S. Miesse, J. B. O'Connell, R. L. Pentland, E. W. Petzing, F. L. Pond, E. D. Porges, T. E. Pratt, I. S. Prenner, E. Renaud, R. N. Reynolds, E. W. Rietz, H. F. Rollman, E. Salsburg, E. J. Schmidt, H. F. Schreiber, S. Shaffer, H. H. Shotwell, H. E. Smith, H. D. Stevers, A. P. Sullivan, T. F. Sullivan, M. L. Summerfield, W. S. Taussig, S. R. Todd, R. L. Walsh, W. T. Watt. T. L. Welch, R. Whitmore, C. F. Wright and A. Zimmerman.

Personal

C. A. Adams Elected President A. I. E. E. — C. A. Coffin Becomes Officer Legion of Honor—H. W. Derry Resigns

H. W. DERRY has resigned as contract agent of the Pittsfield Electric Company, Pittsfield, Mass., to take charge of the motor sales department of the Hartford Electric Light Company, Hartford, Conn. Mr. Derry has for the past five years been associated with the Pittsfield company, and prior to that time was in the employ of the Westinghouse Electric & Manufacturing Company.

F. E. LAUDERBACH has been appointed district manager for the Bussman Manufacturing Company, St. Louis, Mo. He will have charge of the company's sales in the states of Ohio, Pennsylvania, West Virginia, Virginia, North Carolina and South Carolina, Georgia, Florida, Tennessee, Kentucky and Indiana. Mr. Lauderbach was formerly supervising engineer and manager of the St. Louis office of the National X-Ray Reflector Company.

J. C. CHESTNUT, formerly superintendent of the New Castle Electric Company, New Castle, Pa., a subsidiary of the Mahoning & Shenango Railway & Light Company, has become general manager of the Choctaw Power & Light Company, McAlester, Okla. Mr Chestnut has been superintendent at New Castle for the past four years, prior to which he was superintendent of the Shenango Valley Electric Light Company. Sharon, Pa.

CHARLES A. COFFIN, chairman of the board of directors of the General Electric Company, Schenectady, N. Y., and head of the Franco-American Clearing House in New York, has the distinction of being the only officer of the Legion of Honor in America. The French Government, through M. Justin Godard, who is in this country on a special mission, conferred this honor upon Mr. Coffin during a dinner May 13, in recognition of the services he has rendered as a member of the executive committee of the War Relief Clearing House for France, which is now under the direction of the Red Cross, and his efforts to promote the establishment of scholarships in French universities for American students after the war. Mr. Coffin succeeded Judge Robert S. Lovett as the head of the Committee on Co-operation appointed by the Red Cross to negotiate with independent war relief organizations, and as head of the executive committee of the War Relief Clearing House he has been very much interested and active in war service. Mr. Coffin, financier and manufacturer, was born in Somerset county, Maine. He was a manufacturer in Massachusetts prior to 1881 when, with others, he purchased the Thomson-Houston Electric Company. He was active in the management of this company until 1892, when it became a part of the General Electric Company. Mr. Coffin was president of the General Electric Company from the time of its organization until June, 1913, and since then has been chairman of its board of directors.

COMFORT AVERY ADAMS, who has just been elected president of the American Institute of Electrical Engineers, is Lawrence professor of electrical engineering at Harvard University and Massachusetts Institute of Technology, Cambridge, Mass. He was born November 1, 1868, at Cleveland, Ohio, where has was graduated from the Case School of Applied Science in 1890, receiving from this institution in 1905 the degree of Electrical Engineer. In 1890 and 1891 he devoted himself to consulting engineering work and designing, and since 1891 he has been connected with Harvard University, and more recently with Boston "Tech." Until 1896 he was an instructor, from 1896 to 1906 he was

Prof. C. A. Adams.

assistant professor, and since 1906 has been professor of electrical engineering. Professor Adams has also done much consulting engineering work at various times, notably with the organization of Stone & Webster and with the American Tool & Machine Company. He has been a very frequent contributor to the various scientific and engineering societies of which he is a member, devoting himself especially to questions of the design of electrical machinery. He has also written several textbooks and numerous articles for the technical press. He is a fellow of the American Institute of Electrical Engineers, a member of the Institution of Electrical Engineers (Great Britain), American Electrochemical Society, Society for Promotion of Engineering Education, Illuminating Engineering Society, National Electric Light Association, American Association for the Advancement of Science, and numerous other scientific and engineering organizations. He was a member of the International Jury of Awards in the Department of Electricity at the International Exposition in St. Louis in 1904. Soon after the formation of the National Research Council, of which he is a member, he was made chairman of the general engineering committee. He has been very active in co-operating with the Government authorities in active prosecution of the war.

J. D. ELSOM, formerly connected with the Railway Improvement Company, has joined the staff of the Economy Electric Devices Company, Chicago, as an engineer. He will be engaged in the engineering work preliminary to and during the installation of energy-saving campaigns using the Sangamo watt-hour meter, for which the company has the exclusive sales.

M. H. FRANK, for the last two years operating engineer of the Galesburg Railway, Lighting & Power Company, Galesburg, Ill., has been appointed manager of the local division of the Eastern Wisconsin Electric Company of Fond du Lac, Wis., succeeding to the position of A. G. Carson, resigned. Mr. Frank is a graduate of Purdue University and previous to his association with the Galesburg Railway, Lighting & Power Company, he was connected with the Indiana & Michigan Electric Company.

HENRY L. DOHERTY, president of Henry L. Doherty & Company, New York City, was the guest of honor at a party tendered him by his many friends and business associates at the Grand Central Palace on May 15, in honor of his forty-eighth birthday. Among those present were many men prominent in the gas and electrical industry, many of whom came from Denver, Kansas City, St. Joseph, Chicago, St. Louis, Washington, Boston and other cities, where Mr. Doherty has public utility properties. This birthday celebration was of a magnitude in keeping with the magnificent momentousness of the business career of Mr. Doherty, who has risen from the lowly position of an office boy to the head of a $150,000,000 corporation. He is the owner of more than 200 public utilities, scattered over 23 states of the Union and extending into Canada. He is the second largest oil refiner in the world and a scientist and inventor of world-wide fame.

Obituary.

FREDERICK REMSEN HUTTON, honorary secretary of the United Engineering Society and emeritus professor of mechanical engineering in Columbia University, died May 15 at his home in New York City at the age of 65 years. Professor Hutton had been dean of the faculty of engineering at the university from 1899 to 1905 and had written extensively on engineering subjects. He was prominently identified with the American Society of Mechanical Engineers, having served as its secretary from 1898 to 1906 and in the latter year was elected president of the society. He was also a member of the American Academy of Arts and Sciences and the American Museum Natural History.

Financial News

Financial Strength of United States.

That the United States is now the dominant banking power of the world was shown in the annual report of the Comptroller of Currency, presented to Congress on January 30. The Comptroller estimated the banking power of the country at $37,529,000,000, an increase of more than $14,000,000,000 since 1912. In 1890 the banking resources of the world were computed as being only $15,558,000,000. Thus the increase in the United States during the last five years nearly equaled the world's combined banking power 28 years ago. And British financiers have freely conceded that in the Federal Reserve System we have the strongest and largest banking system in the world.

The sound state of our banks is the best possible evidence of the country's unparalleled prosperity, which is further accentuated by the fact that the general stock of money in the United States on March 1, according to estimates made by the Treasury Department, totaled $6,351,548,056, as compared with $5,146,178,093 a year ago. Money in circulation on March 1 amounted to $5,092,530,682, as against $4,583,695,870 a year ago that date. The per capita circulation at the beginning of March was placed at $48.37. On March 1, 1917, it was $44.26. Just before the outbreak of the European War, namely, July 1, 1914, the per capita circulation was $34.35.

The official estimate of the total wealth of the United States for the year 1912, the latest available tabulation, was $187,739,071,090. That we have been creating and storing up great riches since then is well known. Today our national wealth is estimated to be between $225,000,000,000 and $250,000,000,000. Our per capita wealth in 1912 was $1,965, now the average is considerably in excess of $2,000 for each individual.

Steady Increase in Cities Service Company.

Each month shows an increase in the number of stockholders of Cities Service Company, the total for April being 13,398. This means an increase of 18 per cent in the year since the United States entered the war, and indicates that there is still a good investment market.

The following figures indicate the steady growth in the number of stockholders:

1916.	
Dec. 15	10,111
1917.	
Jan. 15	10,529
Feb. 15	10,953
Mar. 15	11,183
April 15	11,954
Dec. 15	12,467
1918.	
Jan. 15	12,768
Feb. 15	13,095
Mar. 15	13,257
April 15	13,398

April Earnings of Page Steel & Wire Show Gain.

April earnings of the Page Steel & Wire Company showed great improvement over those of March, the total net earnings have totaled $84,729, as compared to $29,000 in March. The average of these figures would indicate earnings of 33 per cent on the common stock after dividends on the first preferred and a division of surplus with the second preferred. The common stock has advanced a point to 6½ for the $20 par shares.

Mahoning & Shenango Railway & Light to Issue Bonds.

The Mahoning & Shenango Railway & Light Company, Youngstown, Ohio, has made application to the Public Service Commission for authority to issue $600,000 in bonds to be sold at 90 and $200,000 7 per cent stock. The Interstate Commerce Commission has approved an application by the company to issue these securities.

Byllesby Bond Sales.

H. M. Byllesby & Company have sold to the customers of the utility properties which it manages $4,008,350 of bonds, notes, and preferred stock of those properties since January 1, 1917. Securities of the Northern States Power company account for $1,700,000 of the total. The number of sales made was 5240. Eleven months of this time were included in the war period.

Preliminary Notice of Rate Increases Required.

The Board of Public Utility Commissioners has handed down a ruling ordering all public utility companies in New Jersey proposing to put new rates into effect to notify the Commission 20 days in advance. The order applies to any public utility owning, operating, managing or controlling any street railway, gas, electric light, power, sewer, water or telephone plant or equipment for public use within New Jersey. It is also required that companies file information on the subject with the board.

Copper Exports.

Exports of copper by months exclusive of shipments to Canada and Mexico in gross tons were as follows:

	1918.	1917.	1916.	1915.
Jan.	*40,847	*51,322	23,663	26,193
Feb.	*28,269	*32,265	20,648	15,583
Mar.	22,256	*51,218	26,321	30,148
April		*49,536	21,654	18,738
May		*49,245	16,062	28,889
June		*41,177	39,595	16,976
July		*24,363	35,066	17,708
Aug.		*42,735	32,190	17,551
Sept.		*29,509	29,803	14,877
Oct.		*41,412	33,224	24,087
Nov.		*39,044	22,598	23,168
Dec.		*41,430	26,486	42,426
Total		493,256	327,310	276,344

*Exports to Canada included.

Middle West Utilities Declares Dividend in Script.

Middle West Utilities Company declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable June 1 to stock of record May 20. Dividend is in script, payable in ten years bearing interest at 6 per cent.

In a statement given out at the office of the company, reason assigned for paying the preferred dividend in script is that inability to secure funds, except at prohibitive rates of interest, makes the conservation of its cash resources a necessity to meet the expenditures for a constantly increasing gross business. The regular quarterly dividend of 1½ per cent was paid in cash on March 1.

For the twelve months ending March 31, 1918, the gross earnings of the company's subsidiaries was $1,500,000 in excess of that of the preceding twelve months. Gross earnings for the three months ending March 31, 1918, show an increase of $328,000 as compared with the corresponding period of 1917. Officials of the company believe that a large part of this increase will be permanent. However, increase in gross is more than offset by higher operating costs and the surplus, after payment of preferred dividends will be less in the forthcoming annual report for the fiscal year ending April 30, than in the previous year.

A more reasonable attitude is being taken by municipal officials toward the public utilities and some of the subsidiaries of the company have already obtained increased rates. This, together with advances in the selling prices of other products, brings an increase in revenue of approximately $500,000 annually. The larger part of these increases has not as yet been reflected in their earnings since January 1. Applications before the various authorities for increases, exclusive of those already granted approximate $600,000. With the increases already granted and prospects of further advances, officials of the company feel confident as to the future.

Effect of Daylight Saving on Public Utilities.

Gas and electric companies have suffered some loss in revenue and profits as a result of the daylight savings law, which went into effect on March 31, but the damage to profits has not been "particularly noticeable," the managers say. Detailed reports are not yet available to show with exactness what the effect on earnings of the lighting concerns has been since the clocks were moved forward an hour, but it has been relatively small, particularly upon the earnings of companies which, in addition to an illuminating business, do a large industrial power business. The public utility interests are more concerned about the increases in the cost of materials and in wages.

A representative of H. M. Byllesby & Company, who owns and operates many lighting properties in various parts of the country, states:

"The daylight saving law will not help our lighting companies any, it is true, but with most companies the demands for power for industrial purposes are so heavy that they probably can make up most, if not all, of the loss they incur through this measure. The companies do not apprehend any serious decline in gross revenue will result and if the proper rate increases, which are required because of advancing costs, are granted the effects of such decrease on the net earnings will be overcome. Rate increases, I am glad to say, are being granted companies in many parts of the country, and the outlook along that line is very good."

Dividends.

Copper Range Company has declared a quarterly dividend of $1.50 per share, payable June 15 to stock of record May 22.

Iron Cap Copper Company has declared a dividend of 25 cents a share, payable June 1 to stock of record May 20.

Northern Texas Electric Company has declared a quarterly dividend of $1 a share, payable June 1 to stock of record May 16.

Westinghouse, Church, Kerr Company has declared a quarterly dividend of 1¼ per cent, payable June 10 to stock of record of June 1.

Westinghouse Electric & Manufacturing Company has declared a quarterly dividend of 1½ per cent, payable June 10 to stock of record June 1.

Pennsylvania Lighting Company has declared a semi-annual dividend of 1½ per cent a share, payable May 31 to stock of record May 21.

Philadelphia Electric Company has declared the regular quarterly dividend of 1¾ per cent, payable June 15 to stock of record May 22.

White Knob Copper & Development Company has declared a quarterly dividend of 5 cents per share on preferred stock, payable May 29 to stock of record of May 15.

Federal Utilities, Inc., has declared a quarterly dividend of 1½ per cent on the preferred stock, payable June 1 to stock of record May 15.

El Paso Electric Company has declared the regular quarterly dividend of $2.50 per share on common stock, payable June 15 to stock of record June 5.

The board of directors of the Middle West Utilities Company has decided to pay the preferred stock dividend of $1.50 per share due on June 1 in 10-year 6 per cent interest bearing certificates.

Earnings.

EASTERN POWER & LIGHT CORPORATION.

(Subsidiary Companies.)

A comparative statement of estimated gross revenue for the month of April, 1918 and 1917:

System.	1918.	1917.
Reading	$298,395.61	$240,563.99
Pennsylvania Utilities	127,036.06	92,384.28
West Virginia	90,939.52	87,611.26
Claremont	26,310.00	21,209.54
Total	$542,681.20	$441,769.07

INTERSTATE ELECTRIC CORPORATION.

Interstate Electric Corporation reports for the year ended December 31, 1917, as follows:

	1917.	1916.
Gross income	$ 669,662	$ 649,496
Net income	134,125	147,072
Preferred dividends	60,201	54,894
Common dividends	10,000	20,000
Surplus	63,924	72,178

UNITED GAS & ELECTRIC CORPORATION.

Comparative statement of subsidiary company earnings is as follows:

	1918.	1917.
March gross	$1,366,144	$1,377,827
Net earnings	354,959	545,234
Surplus after charges	28,954	251,478
12 months' gross	16,221,161	15,493,047
Net earnings	5,604,311	6,407,269
Surplus after charges	1,965,756	2,312,548

UNITED RAILWAY ELECTRIC OF BALTIMORE.

For the year ended December 31 last total operating revenue was $10,560,836; operating expenses and taxes, including depreciation, $6,875,160; operating income, $3,685,676; non-operating income, $96,100; gross income, $3,781,777; deductions from gross income, $2,906,190; net income, $875,586.

UTAH SECURITIES CORPORATION.

(Earnings of subsidiary companies.)

	1918.	1917.
March gross	$ 571,237	$ 511,555
Net after taxes	317,109	280,813
12 months' gross	6,811,904	5,830,617
Net after taxes	3,634,241	3,224,300

WESTERN UNION TELEGRAPH COMPANY.

	1918.	1917.
March gross	$7,197,029	$6,095,305
Net operating revenue	1,946,873	2,120,279
Operating income	1,661,216	1,857,825
3 months' gross	20,160,690	16,875,129
Net operating revenue	5,044,193	5,601,070
Operating income	4,169,018	4,970,697

NASHVILLE RAILWAY & LIGHT COMPANY.

	1918.	1917
March gross	$ 218,584	$ 201,328
Net	77,108	64,237
Interest, etc.	40,980	40,906
Surplus	36,128	23,331
12 months' gross	2,471,564	2,115,890
Net	870,949	921,483
Interest, etc.	489,600	503,298
Preferred stock dividend	125,000	125,000
Balance	256,349	293,185

CHICAGO TELEPHONE COMPANY.

Earnings, three months, to March 31—Gross, $5,582,576; increase, $231,371; net, after taxes, $1,149,636; decrease, $78,895. March earnings—Gross, $1,828,246; increase, $31,100; net, after taxes, $463,576; increase, $920,227.

AMERICAN WATER WORKS & ELECTRIC COMPANY.

Reports for the three and six months ended December 31 last as follows, in comparison with the previous year:

Three months—	1917.	1916.
Gross earnings	$3,319,998	$2,912,001
Net earnings	320,036	336,466
Net income after charges	117,014	130,194
From July 1 to December 31—		
Gross earnings	6,530,256	5,655,346
Net earnings	696,631	736,619
Net income after charges	290,581	330,543

MONTANA POWER COMPANY.

For the three months ended March 31, 1918, gross increased $15,611, net decreased, $60,458, surplus after charges decreased $98,283.

VIRGINIA RAILWAY & POWER COMPANY.

	1918.	1917.
April gross	$ 642,520	$ 506,072
Net earnings	283,764	261,176
Surplus after charges	135,002	115,421
10 months' gross	6,098,986	5,003,468
Net earnings	2,779,473	2,588,432
Surplus after charges	1,282,313	1,155,287

AMERICAN CITIES COMPANY.

For three years ended December 31:

	1917.	1916.	1915.
Total income	$1,191,904	$1,418,923	$1,405,089
Other exp...	222,753	224,502	227,259
Interest, etc.	666,356	527,500	500,000
Surplus...	$ 302,795	$ 638,196	$ 667,830

NEVADA - CALIFORNIA ELECTRIC CORPORATION.

	1918.	1917.
February gross	$ 162,813	$ 126,623
Net after taxes	85,580	65,376
Surplus after charges	18,850	12,481
2 months' gross	318,012	257,631
Net after taxes	175,028	134,628
Surplus after charges	48,662	31,734

HAVANA ELECTRIC RAILWAY, LIGHT & POWER COMPANY.

	1918.	1917.
March gross	$ 642,110	$ 545,397
Net after taxes	352,523	329,306
Surplus after charges	222,757	163,849
3 months' gross	1,904,191	1,597,210
Net after taxes	1,071,924	954,759
Surplus after charges	684,950	467,297

WESTERN UNITED GAS & ELECTRIC.

The Western United Gas & Electric Company, which serves 63 cities and towns near Chicago, presents an income account which compares as follows:

	1917.	1916.
Operating income	$1,810,504	$1,571,710
Operating expenses	1,144,809	937,363
Net operating profits.	665,694	634,347
Other income	36,386	33,527
Total net income	702,080	667,874
Interest and amortization	355,951	321,588
Net earnings	346,128	346,286
Dividend on preferred	90,000	90,000
Dividend on common.	180,000	180,000
Surplus for year	76,128	76,286

NORTHERN OHIO TRACTION & LIGHT COMPANY.

For the year ended March 31 last gross earnings of the Northern Ohio Traction & Light Company were $6,559,130, an increase of $1,015,351; net income, $1,353,684, decrease $232,128; balance after dividends, charges, etc., $828,485, decrease $250,176.

MICHIGAN STATE TELEPHONE COMPANY.

For the three months to March 31—Gross, $2,036,072, increase $72,099; net, after taxes, $283,604, increase $144,525. March—Gross, $679,817, increase $18,495; net, after taxes, $95,483, increase $83,041.

NEW YORK TELEPHONE COMPANY.

For the three months to March 31—Gross, $15,551,788, increase $944,056; net, after taxes, $3,625,537, decrease $822,930. March gross, $5,314,467, increase $334,578; net, after taxes, $1,224,297, decrease $257,472.

DETROIT EDISON COMPANY.

	1918.	1917.
Gross revenue	$1,090,297	$ 977,668
Net revenue	300,319	303,160
Balance after deducts.	198,422	218,427
For four months—		
Gross revenue	4,650,850	4,166,105
Net revenue	1,367,290	1,457,472
Balance after deducts.	973,895	1,117,796

COLUMBIA GAS & ELECTRIC COMPANY.

The April surplus of the Columbia Gas & Electric Company and subsidiaries decreased $1,347. From January 1 the surplus increased $2,355.

CITIES SERVICE COMPANY.

For April—	1918.	1917.
Gross earnings	$1,885,750	$1,609,013
Net earnings	1,848,497	1,578,125

WEEKLY COMPARISONS OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate. Per cent.	Bid May 14.	Bid May 21.
Adirondack Electric Power of Glens Falls, common	6	12	12½
Adirondack Electric Power of Glens Falls, preferred	6	80	71
American Gas & Electric of New York, common	10+extra	..	88
American Gas & Electric of New York, preferred	6	39½	40
American Light & Traction of New York, common	..	190	194
American Light & Traction of New York, preferred	6	94½	95
American Power & Light of New York, common	4	40	40
American Power & Light of New York, preferred	6	..	68
American Public Utilities of Grand Rapids, common	..	..	..
American Public Utilities of Grand Rapids, preferred	6	..	..
American Telephone & Telegraph of New York	..	98	98½
American Water Works & Elec. of New York, common	..	4⅞	4¾
American Water Works & Elec. of New York, particip.	7	13	13
American Water Works & Elec. of New York, first preferred	..	57	57
Appalachian Power of Bluefield, common	..	3¼	3
Appalachian Power of Bluefield, preferred	7	20	20
Cities Service of New York, common	+extra	212	210
Cities Service of New York, preferred	6	73	75½
Commonwealth Edison of Chicago	8	103	102½
Comm. Power, Railway & Light of Jackson, common	..	21	21
Comm. Power, Railway & Light of Jackson, preferred	6	44	45
Federal Light & Traction of New York, common	..	6½	3
Federal Light & Traction of New York, preferred	..	30	26
Illinois Northern Utilities of Dixon	6	..	..
Middle West Utilities of Chicago, common	2+extra	15	15
Middle West Utilities of Chicago, preferred	6	53	..
Northern States Power of Chicago, common	ex.div.7	43	44
Northern States Power of Chicago, preferred	ex.div.7	84½	85
Pacific Gas & Electric of San Francisco, common	..	34	33
Pacific Gas & Electric of San Francisco, preferred	6	81	80
Public Service of Northern Illinois, Chicago, common	7	73¾	74
Public Service of Northern Illinois, Chicago, preferred	6	86	82
Republic Railway & Light of Youngstown, common	4	22½	22½
Republic Railway & Light of Youngstown, preferred	6	58	58
Standard Gas & Electric of Chicago, common	..	4½	4½
Standard Gas & Electric of Chicago, preferred	6	24½	24½
Tennessee Railway, Light & Power of Chattanooga, common	..	2¼	2
Tennessee Railway, Light & Power of Chattanooga, preferred	6	9¾	9
United Light & Railways of Grand Rapids, common	4	29½	30
United Light & Railways of Grand Rapids, preferred	6	62	61½
Western Power of San Francisco, common	..	12	12
Western Power of San Francisco, preferred	6	49½	49
Western Union Telegraph of New York	extra	94	92
Industrials—			
Electric Storage of Philadelphia, common	4	49½	49
General Electric of Schenectady	8	148	150
Westinghouse Electric & Mfg. of Pittsburgh, common	+extra	41½	44
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	62	59

*Last sale.